JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JULY, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.

By John C. Trautwine, Civ. Eng., Philad.

Continued from p. 373.*

The River Pato. The Pató is but an insignificant stream. Like the Napipí, it is very circuitous; and we found its channel to be much encumbered by trees and logs from its mouth to its sources.

I did not take the bearings of its sinuosities; but merely estimated its length by repeated observations of our rate of motion. According to this process of computation, we ascended it for 34 miles, although in a straight line, the distance would certainly not have exceeded about one-half that amount.

At three miles above its mouth, its width varies from 30 to 50 yards, with centre depths from five to eight feet at the time of our visit. At its lowest stages, the depth here occasionally becomes so reduced for days at a time, as barely to allow a free passage for large ranchadas.† Along

* Errata in last Number, p. 365, last line, and p. 366, fifteenth line from top, for *transition*, read tertiary.

† Wherever remarks of this kind are made, the reader will understand that they are in accordance with the representations of my boatmen, or of the natives living on the banks of the streams. The former were well acquainted with the Pató, and other streams which I explored.

here we noticed the first bamboos we had yet met with. We also passed a bluff of red and gray clay and gravel, 30 feet high.

At six miles from its mouth, the Pató receives a branch called the Chiraguandó, coming from the south. At this particular point we found the width reduced to about eight yards by obstructions caused by a formation of hard cemented gravel; while the depth was increased to ten or twelve feet.

About here, the banks begin to be considerably higher than at the mouth, being generally from six to nine feet above the surface of the water, as we found it; and in some spots, where the stream washes hillocks of stiff diluvial clay and gravel, the ground is elevated as much as from 15 to 30 feet. In this vicinity we also noticed the freshet marks on the trees, as high as 12 feet above the water, showing that the ordinary banks must at times be overflowed to a depth of several feet.

At about 9, as well as at 11 miles above its mouth, the stream cuts through low ranges of diluvial hills of from 30 to 100 feet in height, and having a general direction nearly north and south. Along here, the average width is about 25 or 30 yards; the current just two miles per hour in the swiftest parts of the cross-section; although to the eye it appeared much greater, in consequence of the splashing over fallen trees, logs, &c. Above the nine mile point, the firm diluvial banks are frequently quite perpendicular to a height of from 20 to 60 feet. These vertical faces, however, are sometimes clothed with vegetation, such as ferns, the musa, &c. In many cases they appeared to be *shingled*, as it were, with the musa leaves, presenting an odd and interesting sight.

The musa leaf furnishes a very convenient as well as effective shelter from the sun and rain. It generally attains a length of about five feet, but we found some on the Pató as much as seven feet long. It resembles somewhat the plantain leaf.

There are two or three varieties. That commonly used is called the "hoja blanca," or "white leaf." One side is smooth, but the other is covered with a white fuzz, which sheds off rain perfectly. When the canoe has a toldo, the top is covered with two or three layers of these leaves; and when destitute of that luxury, a few of them are laid on top of the baggage and held down by stones. Sometimes our boatmen would insert one end of a leaf between the backs of their heads and their hats, letting the leaf fall down their naked backs as a protection from the chilly sensation produced by the falling rain-drops.

Early in the afternoon, there was every indication of a very heavy rain, and we stopped for the day at an Indian hut, some 15 miles above the mouth of the Pató. At this distance, the width of the stream diminishes to an average of from 50 to 75 feet, with an ordinary depth ranging from 4 to 6 feet in the channel-way.

The proprietor of the house, with his family, consisting of wife and child, were absent when we stopped; but we were readily admitted by his father-in-law, whom we found at home. The others, however, arrived about an hour afterwards in a canoe, in the midst of the rain. In passing from the canoe to the bank, the woman had to walk a floating log, a few yards long, and in order to have the free use of her arms to balance herself, she pitched the child (about eighteen months old) upon

her back, to which it clung, as the young monkeys do, apparently by instinct, exhibiting as little apprehension as herself, as she with difficulty retained her footing on the rolling log. All the family were destitute of clothing, except that article of apparel which, with us, pertains exclusively to infants.

The hut was about eighteen feet square, and raised several feet above the ground on posts. It consisted merely of floor and roof, without sides, or any protection from the wind or slanting rains. The Indians appear to be much less provident in this respect than the blacks; for the houses of the latter always have sides, while those of the former are generally without them. The floor was composed of rudely split strips of the palm laid loosely side by side; and the roof, of palm leaves.

For furniture, they had two earthen pots, a few calabashes, a machete or long knife, a pebble for sharpening it, an extremely rude axe, three or four twig baskets of their own manufacture, a small piece of home-made net, a blow-gun, and a bow and arrows; while their entire wardrobe consisted of half a dozen small pieces of rag strung up on the posts of the hut. Their bedding comprised only two wide strips of the inner bark of the damagua tree, and a few short, flattened logs for pillows.

When the Doctor and I had finished our supper of sardines, biscuit, and claret, we presented our hostess with the box and bottle. These splendid articles were handed around, and greatly admired by the family. A few minutes after receiving them, the woman went out in the rain, and soon returned holding a live chicken by the wing. This she offered to me as an evidence of her gratitude for the valuable present she had received, and appeared disappointed at my refusing to accept it, until I proposed that she should keep it for me until our return.

On the opposite side of the stream, they had a small patch of plantains. This fruit, together with the results of their fishing and hunting, were their chief dependence for food. A few pigs and chickens are generally kept by the Indians, but these are reserved for special occasions of festivity, or scarcity of other means of subsistence.

Early in the evening the Doctor and I hung up our hammocks, and turned in. Our boatmen enveloped themselves in their blankets, and stretched themselves out on the floor, each with a log pillow under his head; while our host and his family lay down huddled together on their strips of damagua bark, without any covering whatever. The rain was pouring in torrents, and the wind sent it flying through the hut, so that we were all very essentially ducked. The lightning was performing in brilliant style, and allowed me to see the exposed condition of the mother and child, upon whom, however, the rain appeared to fall as unheeded as upon the palm strips upon which they lay. Still I could not endure the sight. One of my blankets was folded up under my head as a pillow; and the other at my feet, as a reserve in case of feeling too cold before morning, as is generally the case. Converting one of them into a ball, I aimed at the broadest part of the lady's body, and fired; it took effect, for she bounced up, directing her vision towards the monster (not me, but the blanket,) that had so rudely disturbed her slumbers. After enjoying her bewilderment for a moment, I explained the phenomenon, and endeavored to prevail on her to use the blanket to cover herself and

child. She laughed good naturedly, and having quietly hung the blanket to a post of the hut, lay down again: while I, disappointed in the result of my benevolent intentions, settled myself once more into my drenched hammock, inwardly resolved nevermore to be so excessively polite to an Indian woman; a resolution the more easily kept, as they are stupendously homely.

Next morning our boatmen expatiated on the pecuniary value of the blanket, and on my generosity in giving it away. The circumstance had evidently produced a favorable impression, and the entreaties that I should take the chicken with me were renewed. It was declined, however, to the evident chagrin of the boatmen, who knew better than I that we should soon be glad to have it.

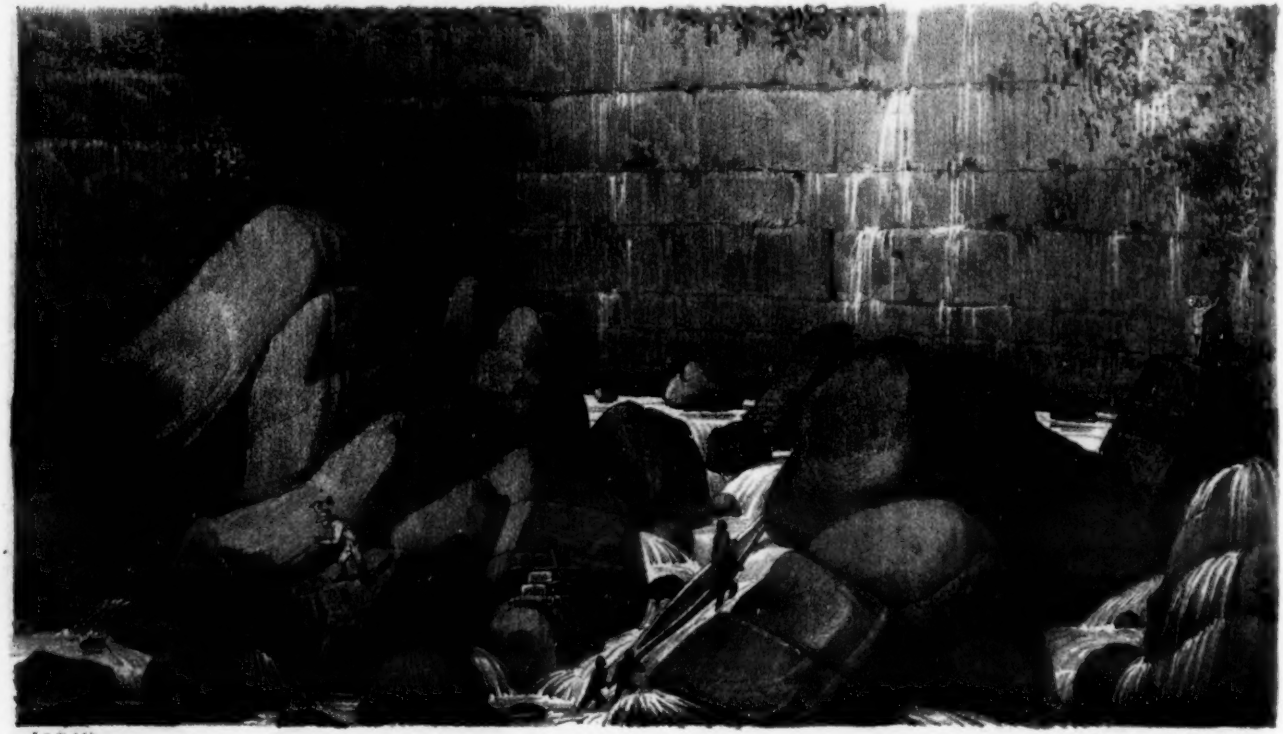
With some difficulty a few dimes were forced upon our host at starting. He inquired my name, and finding it was John or Juan, he was much gratified, inasmuch as it was also his own, or as he gave me it more in extenso, Juan de Dios (John of God).

A few hundred yards above the hut, we passed the mouth of the branch Pavarandó. At some 2 or 3 miles above this stream the ground becomes more generally elevated, and presents many isolated conical hills; while the river banks are at times bluffs of from 30 to full 100 feet in height. These in some cases descend to the stream by easy slopes, and in others form perpendicular faces of indurated grey and brown clay, and sand; generally, however, the banks for 15 miles above the Pavarandó are of mud and fine sand, interlaid with beds of dead leaves, and branches. Some pieces of the hardened clay on being split exposed black impressions of leaves; and at 8 miles above the Pavarandó we found two or three rolled pieces of compact black lignite. At this latter point, the average width of the stream is about 50 feet; and its depth, swelled by the hard rain of the previous night, about 5 feet in mid-channel; ordinarily, however, it is but 2 or 3 feet.

At 12 miles above the Pavarandó, or 27 miles from the Quíto, the Pató again divides into two apparently equal branches. The men, however, told me that the northern one was merely a long wash, or quebrada. From this point, up to the head of the stream, boatmen have frequently to drag their ranchadas for nearly the whole distance. We, however, in consequence of the rain, still had 2 or 3 feet of water in the channel, with a current of full two miles per hour.

We here saw freshet marks as high as 16 feet above the water surface. For some miles back the stream was frequently so choaked up with fallen trees that we were compelled to get out, unload, and force the boat under them, or over them, as the case might be.

Early in the afternoon, after having traveled about 14 miles, or 29 miles in all from the Quíto, we came to an unoccupied, temporary, half ruined shelter of leaves, placed on forked sticks, and about six feet high at the highest part. Our patron advised us that as this was the last shelter we should meet with before crossing the partition ridge, and reaching the Baudó, we had better stop here for the day, and thus have the whole of to-morrow for crossing, and examining the country; otherwise, as the navigation was becoming every hour more slow and fatiguing, we could go on a mile or two farther, and construct a shelter of



J. C. T. del.

P.S. Duval & Co's Steam lith. Press. Philad.a

VIEW ON THE PATÓ, NEAR ITS SOURCE.

branches ourselves. We preferred the former alternative, although our domicile offered but few attractions. It had no sides,—no floor except the wet ground,—nor were the sticks which supported the roof sufficiently high or strong to allow us to swing our hammocks. Indeed, the only favorable trait in its construction was the facility which the roof offered for the contemplation of the starry firmament, on those rare occasions on which it is visible. But "where there is a will, there is a way," so we made a dry floor of branches, and cut a few musa leaves to cover ourselves in case it should rain during the night. Then we built a fire, put on some plantains to roast for supper, and took a bath. A stroll was of course out of the question, here, as almost everywhere else in this region, on account of the mud, and dense wild vegetation. We were therefore compelled to resort for occupation to our segars, and surmises as to what to-morrow would bring forth. Soon after dark our men talked themselves to sleep with appropriate discourses about tigers and snakes; but the novelty of our situation, and the exciting anticipations of to-morrow, in connexion with the pattering of the rain, and the flashes of lightning, kept the Doctor and myself awake until midnight. It rained all night, but not heavily; so that by shifting our positions occasionally, we managed by help of our musa leaves to keep ourselves tolerably dry. Fortunately we had no musquitos, and but few sand-flies to trouble us. By early dawn we had made and drunk our coffee, and were prepared to start. By our patron's advice we took down our toldo, and left it behind, as the increasing number of fallen trees would render it impossible to preserve it as we forced the boat under them.

We were now but 5 miles from the Cabacéra, or place of disembarkation, from which point we were to cross the dividing ridge between the waters of the Atlantic and Pacific, on foot.

In sight from our humble shelter of the previous night, and towering above the wet, rank, vegetation around us, two or three isolated conical hills, some 300 or 400 feet in height, reared themselves directly in our path, giving rise to unpleasant forebodings. Their slopes, although very steep, were densely covered with trees and undergrowth.

At 1½ miles from our starting point we passed banks of soft gray argillaceous sandstone, containing shells and a little lignite. Large boulders of this rock now begin to obstruct the stream in many places; and at certain points its nearly horizontal strata constitute the entire bed. See Plate I.

At many points we barely cleared the rocks on each side by an inch or two; and the water flowed through channels which almost appeared to be artificially excavated in the solid stone. We had sometimes to unload the ranchada, and assist the bogas to lift her up little cascades; at other times we would walk in the stream, and help buoy her up in shallow places, or press her down into the water to pass under large fallen trees.

At 1½ miles below the Cabacéra the stream divides into two nearly equal branches. The one to our left is called the Pató; and that to our right, which we followed, the Pié. The last two miles were by no means destitute of the picturesque on a moderate scale. Numerous little rain cascades, some of them 100 feet in height, leaped headlong down the

perpendicular banks, scattering their spray over the ferns and festooned vines which clung tenaciously to a scanty foothold among the rocks. At other times they coursed wildly down the steep ravines of the high hill bluffs, and mingling their waters with those of the pretty, transparent, little Pató, gamboled frolicksomely among the boulders of indurated clay, and soft grey sandstone, which in vain endeavored to arrest their progress; or demurely pursued their penitential way though level pools created by the fallen trees.

I judged the descent of the stream for the last mile to be between 50 and 60 feet, as nearly as I could estimate by an occasional use of my hand-level. Within the last half of its length, the Pató has a great number of small tributaries: we counted full 30 of them.

We were about four hours in traveling the last 5 miles to the Cabacéra, at which point we arrived at 10 A. M. Here the stream again subdivides into two rivulets, in neither of which would our ranchada float empty.

As there was no hut here, we made a fire, and cooked our breakfast, by the side of the stream.

This over, we dragged the boat to a point sufficiently high to secure her against floods during our absence; and having concealed our heavy iron cooking pot in the woods, the crew took our baggage on their backs, supporting it by a strap around their foreheads; and precisely at noon, our unpretending expedition took up its line of march on foot for the waters of the Pacific. The Doctor, with his fowling-piece in one hand, and a roasted plantain in the other, constituted the military;—the three bogas,—the baggage train; and I, with a compass, tape-line, level, and bottle of schnaps, filled the scientific department.

For the first few hundred yards our path occupied the bed of the stream; then suddenly turning to the west, we began the ascent of the ridge of partition. It required but a glance to convince us that Father Ochoa's 18 feet must be remarkably long ones, (expanded perhaps by a tropical climate;) and I sullenly drew from my pocket that invaluable instrument for explorers, the hand-level of Dr. Locke of Cincinnati.

With this instrument I at once began to level up the steep ascent, and continued to do so until we had attained a height of 500 feet. At this elevation I stopped levelling, but we rose I judged *at least* 200 feet more before we reached the summit. From the summit the descent towards the west was very abrupt, so much so that we sometimes descended 50 feet vertically in a horizontal distance of 25 feet, letting ourselves down almost perpendicular precipices of rock by aid of the vines and bushes that grew on them. A dog who accompanied us would stand howling piteously at the top before making his plunge, and then pitch down head over heels. The actual time consumed in walking across this ridge from the Pató to within a few hundred yards of the River Baudó, was an hour and three-quarters, independently of rests. Our rate of progress being very slow, on account not only of the steepness of the path, but the mud, the Doctor and myself assumed the distance at about three miles. For near one-third of this, the route presented a somewhat novel feature to both of us, and one which I hope not to encounter again. The novelty consisted in a narrow path, varying in breadth from 2 to 8 feet; and bounded on both sides by nearly vertical descents of from 50 to full 200 feet.

I am very subject to a distressing vertigo when looking down great depths, and can compare my sensations on this occasion to nothing but a frightful night-mare. The tendency to throw myself down the precipice was almost irresistible, and only counteracted by crawling over the worst places on all fours, with my face close to the ground.

Dr. Halsted, on seeing to what extent I suffered, advised a retreat, to which of course I could not assent. The men offered to carry me on their backs, which is a common mode of transporting travelers in this part of the world ; but neither did this species of locomotion meet my approbation. I told one of them however to walk but a single step in advance as I crawled along the worst spots, so that if by chance I should lift my eyes from the ground they should rest on him instead of the descent before me. At one point however even this precaution nearly failed. For some few yards the path was scarcely two feet in width, and I could not avoid seeing down the abyss if I kept my eyes open. I felt as if suspended by a hair at an immense height, and was compelled to close my eyes. Dr. Halsted holding on by a sapling, leaned over, and reported no soundings at less than 200 feet.

It required a desperate effort on my part to pass this spot, and nothing but the fear of disgrace induced me to make it. The Doctor and our bogas were not in the least affected; indeed, the gratification, coolness, and carelessness of the former appeared to vary inversely as the width of the path; while the latter, trudging along unconcernedly with their loads, were entirely at a loss to comprehend the cause of my undignified manœuvres.

The feature which most astonished us was, that a great portion of this abominable route, instead of rock, consists of clay and gravel, supporting a vegetation not only of grass and shrubs, but of full sized trees. The only cause I can assign for the permanence of those high steep slopes, of such materials, is the absence of frost.

The rock which showed itself at various points, both of the ascent and descent of the ridge, as well as at its summit, is the soft grey tertiary sandstone with fossil shells, before alluded to. Among the broken boulders near the head of the Pató we saw many portions of large fossil conch shells, and selected several specimens to bring home, but as we did not return by this route, they were left behind.

Throughout the entire exploration, we had, in compliance with the request of friends at home, maintained a diligent, but unavailing search for land and fresh-water shells. Perhaps the fact of the frequent inundations is unfavorable to their development ; as may also be the muddy condition of the water in times of flood.

In crossing from the Pató to the Baudó, we did not see a single bird, or wild animal of any kind ; and but two or three small birds along the upper part of the Pató itself.

At the western foot of the ridge we found a large hut consisting only of floor and roof; raised several feet above the ground as usual, to avoid the floods of the Baudó, which flows within a few hundred yards of it. This hut had no regular tenant, but had been constructed for the accommodation of persons traveling this route. We found it empty; and at once took possession for the day. As soon as we arrived, I sat the men to work to clear away a few trees for observing the latitude in case the

night should be clear, as it promised to be. Having only their machetes, however, this proved to be slow work. The largest of the trees in falling came very near crushing the hut to pieces; but worst of all, just as we had cleared a space sufficient for our purpose, the heavens became suddenly overcast with clouds, and so continued, with occasional showers all night.

By degrees, as evening closed in, other travelers made their appearance at our hut, in the shape of natives who had ascended the Baudó with canoe-loads of plantains, which they were taking to Quibdó for sale. They carry all their produce on their backs over the route we had just passed; and when occasionally they have larger cargoes than they can transport at one load, they make the trip two or three times in the same day. Yet the entire value of the load carried by each one probably averages but a dollar in Quibdó, after having been transported 50 or 75 miles. As there is no regular system of canoes on the opposite sides of the ridge, in the event of finding no boat on the side opposite that from which they came, they construct small rafts of branches tied together by vines, and thus drop down the stream with their loads.

They and we were of mutual assistance to each other; for as I had determined not to recross the ridge by the same villainous route, there was a prospect that we might have to build a raft for navigating the Baudó, until we should chance upon some other pathway back. So we told them they might have our large boat, on condition of delivering it safe at Quibdó; and they in return put us in the way of procuring one sufficient for our purposes.

When we retired for the night, we formed an interesting group, consisting of 2 whites, 18 naked negroes and Indians, (among them one woman,) and 2 dogs, all stretched out on the floor of a hut 20 feet square.

The dogs probably enjoyed the night less than any of us; for the bipeds soon found that when a dog lay down near him, he attracted more than his due share of sand-flies; a very natural consequence of which was that at intervals of about every half hour during the night a dog was pitched or kicked headlong from the floor down to the ground. In appreciation of the compliment he would entertain us with a short serenade, and then come back to try his luck with some other sleeper; but always with the same result.

Before we left Quibdó, Governor Conto had considerately prepared for us in his official capacity, a written document, enjoining upon those to whom we might have occasion to present it, a due consideration for our necessities, and the conferment of such aid as we might reasonably require of them. He regarded the object of our mission as one that might eventually contribute in some measure to advance the prosperity of New Granada, and neglected no means that would conduce to the furtherance of our examinations.

Had it not been for this paper, we should probably have been compelled to resort to a raft; but by its aid, backed by a liberal compensation, we next morning obtained the ranchada, of which our friends of the hut had spoken the previous night. We of course engaged to send it back when we should have done with it. A quarter of an hour's stroll through the muddy woods brought us from the hut to the Baudó, where

lay the ranchada. This was but two feet wide, and one foot deep; and with our load drew full 8 inches, leaving but 4 inches above water. We soon discovered to our great disgust that she was badly addicted to rocking and leaking; which qualities, combined with the absence of all shelter from the sun and rain, rendered her anything but a desirable craft for a voyage of nearly 100 miles. But we had no alternative. To our great surprise, we found this stream to be (instead of the insignificent creek which we had expected) a really fine navigable river even at the point at which we struck it; and at which we had been led by the map to suppose we should encounter its very sources. How far it reaches above this point we could not ascertain; but I have, in my map, (Plate XII, vol. xxvii,) given it the least extent that I considered at all warrantable by its magnitude at our place of embarkation.

Here we made a careful measurement of the width, and found it to be 210 feet; and the depth nearly all the way across 14 feet. Yet we were told that the water was rather below than above its ordinary stages; and so indeed the line of no vegetation, which was above the surface, showed it to be. The current was scarcely two miles per hour in the swiftest part of the cross-section. The banks at the same time varied in height from 5 to 10 feet above water, and consisted of mud so soft that I had to use a pushing pole laid flat on it, to prevent me from sinking into it as I measured a base with my tape-line.

We were told, however, that the river occasionally falls so low as to have here a channel depth of but 5 or 6 feet for some days at a time; while, on the other hand, in high floods, the depth increases to full 25 feet, overflowing all its banks. Back from the river, on both sides, the ground is soft and muddy, but the levees are by no means so marked as in the Atrato. As we descended, the ground gradually became more swampy.

From what I had heard at Quibdó of the limited depth of the San Juan at San Pablo, and for a considerable distance below it, I now felt pretty confident that the Baudó was in itself the better river of the two, for the purpose of an inter-oceanic Canal, provided we should be able to find a low pass through the partition ridge, for uniting it with the Quitó. Under this conviction, I at once determined to examine it carefully to its mouth; and immediately commenced taking its bearings, distances, and soundings.

The first two features are shown on the map (Plate XII, vol. xxvii,) which has been protracted from my notes: and our subsequent exploration of the river for 85 miles to its mouth, proved that I was not mistaken as to its general character.

In no cross-section below the place of embarkation, (except near the mouth,) did I find a less maximum depth than 14 feet for the same stage of the river, even in wide places. The width, however, is by no means so variable as that of the upper portions of the Atrato, which circumstance tends to a greater uniformity of depth. Still there are certain comparatively contracted spots, at which the yielding nature of the river bed insures a proportionate increase of depth.

Thus, at about 17 miles below our starting point, at an Indian hut, where we stopped for the day, we found the narrowest part of the river we had yet met with. Here the width was contracted to less than 150 feet, by a

bluff of the soft grey tertiary sandstone, or, more properly speaking, indurated sandy clay, with shells, before spoken of; and the depth on the concave side of the bend was 33 feet, diminishing to 9 near the convex bank. But thus far the river had preserved a remarkable uniformity, not only of width and depth, but of the height of its banks. Even here we found the most rapid part of the current to be but full 2 miles per hour.

To-day we passed a few alligators; also some sunken trees, the removal of which would be necessary should steamboats be introduced on the river. We also saw a few of that diminutive species of monkey called the titi; and shot what is here called a wild turkey. Being no ornithologist, I can venture no farther than to say, that, although *not* a wild turkey, it sufficed to make a capital supper for us all.

We stopped early in the afternoon in consequence of a very heavy rain, to which we were fully exposed, inasmuch as our boat had no toldo. Some musa leaves laid on our baggage, kept it dry; and by constant bailing with a calabash, we kept the boat afloat for an hour after the rain began, until we reached the hut, which was only the fifth one we had yet passed on the river. The posts on which the floors were raised were usually from 4 to 6 feet above the ground. The small number of huts was explained by our bogas as a consequence not only of the want of elevated spots on which to erect them, but of the swarms of sand flies and other insects which infest the low marshy margin of the stream. Of the justice of this argument, we had ample demonstration whenever we got among the bushes to measure base lines. On such occasions we generally shipped a full load of them, and always found it hard work to get entirely rid of them for some time after starting again.

The hut was open on all sides, and was occupied by quite a large family of Indians. One of the men we noticed was taller than any Indian we had yet seen; but on measuring him he resulted in but 5 feet 7 inches. The dress of both sexes was the fashionable one of a solitary rag.

It appeared that they had recently been successful in their hunting, for the remains of several wild hogs and some large fish were suspended from pieces of vine in all directions across the hut, diffusing an odor very unlike those of Araby.

On a layer of clay placed on the palm-strip floor, a fire was burning, apparently for preserving the meat. The smoke from it filled the hut, notwithstanding the want of sides; and with the smell arising from some dozen hogs which resided a few feet below the open floor, forcibly reminded us of the cabin of our river boat on the Atrato.

Here, as at every other stopping place since leaving Quibdó, the cloudiness of the night prevented us from observing the latitude. The rain to-night raised the river four feet. The flood marks here were 12 feet above the water of last night, or 8 feet above that of this morning. Our host told us that the *ordinary* stage of the river might be considered as comprised between these two limits.

The next day we descended the river 21 miles further, or about 38 miles in all from our place of embarkation upon it. Thus far the river retains its average width of but a little more than 200 feet; but occasionally widens to 300 for short distances. The latter was the width at our second stopping place. On taking soundings here, I was surprised at its

great depth, inasmuch as a shallow channel was naturally to be expected at so broad a point. From the banks the soundings increased to about 45 feet at the distance of 100 feet from each shore, while the inner 100 feet gradually increased from 45 feet at the edges up to 51 feet in the centre.

Yet at a point but a mile below, where the width was the same, we found a maximum depth of but 21 feet, and the transverse area of the cross-section but one-half that of the upper one. On reflection, I was led to ascribe the great depth at the former point to the action of the *remolinos*. These are currents near the banks, which run (in many instances rapidly) in a direction contrary to the downward one of the central portions of the river. These upward currents are very common throughout all the rivers of New Granada that I have seen, as, for instance, the Chagres, the Magdalena, the Atrato, the Baudó, the San Juan, &c. The boatmen always avail themselves of them, and it is not uncommon, in some of them, to see, at the same time, boats dropping rapidly down the river by the central stream, and others passing as rapidly up it, with no other propelling power than the remolinos of the side channels.

Some of the remolinos of the Baudó struck me as being by far the most remarkable I had ever seen; and in the deep section to which I have first alluded, they were beautifully illustrated. The two upward currents occupied full two-thirds of the entire width, and appeared nearly to equal the central one in velocity.

I conceive that we may regard these remolinos as virtually reducing the width of the channel-way of the descending stream, and thus tending to induce a corresponding increase of depth. This suggestion is offered with due diffidence, inasmuch as I am not aware that this deepening effect of the remolinos has ever before been observed, or at least ascribed to that cause.

The various tributaries which enter the Baudó, appear to affect its width but little, until we descend a considerable distance below the town of Baudó. Their action operates chiefly in increasing its depth. Although it rained hard for several hours last night, the river fell 4 inches.

(To be Continued.)

---

*Experiments with Robbins' Self-acting Brakes for Railway Carriages.**

An important incident in railway history, and one in which the public safety is intimately interested, took place on Wednesday last (the 11th inst.) when an experimental run was made from Waterloo station to Windsor, for the purpose of testing the efficiency of Major Robbins' invention for applying self-acting brakes to railway carriages. The train consisted of engine and tender, with a brake van and 16 carriages, only eight of which, however, were furnished with this new contrivance. The object of thus lengthening the train by these eight carriages unfurnished with the apparatus was to put to a severe test the facility of backing with the self-acting brake—a part of the experiment about which some slight doubt had existed, but which proved, even under disadvantageous

* From Herapath's Journal, No. 762.

circumstances, triumphantly successful. There were present several engineers and men of science connected with the leading railways of the country to witness this important trial. The first stoppage made was at the Wandsworth station, which, being near the junction, the speed attained did not exceed 20 miles an hour; proceeding at which rate the train was brought to a stand, without perceptible abruptness, in an incredibly short distance. Between this station and Putney, a speed was reached of 35 miles an hour, when a second experiment stopped the train within a distance of 250 yards. It is important to remark that an ordinary train proceeding at this rate could not be stopped in less than 800 yards. The next experiment was tried at a speed of 40 miles an hour, in which the stoppage was effected in 450 yards, and in about 50 seconds of time. On returning from Windsor, fog signals were placed upon the line in situations unknown, till they announced themselves by their explosion, to any person on the train. On passing over the first, the train was advancing at a speed of 35 miles per hour. The steam was instantly shut off, which process alone immediately brings this brake into operation, and the train was brought to a stand at 460 yards from the point at which the signal exploded. Had all the carriages been furnished with these brakes, and the experiment thus disembarrassed of the additional *momentum* caused by the eight unfurnished, there can be no doubt that the stoppages would have been effected in a much shorter time and distance. On the return of the train to Waterloo, it was evident that the trial had proved highly satisfactory. The great difficulty in connexion with self-acting brakes has always been, that of so arranging the apparatus as to allow the engine driver to back his train as occasion might require. The difficulty, it would appear, has been entirely overcome by the invention of Major Robbins, the train having been repeatedly shunted in the course of the experiments for the purpose of testing its capabilities in this respect. While the train was stopping at Windsor, Prince Albert, accompanied by a party from the Castle, visited the station, for the purpose of inspecting the contrivance. Major Robbins had the honor of being presented to his Royal Highness, and of explaining to him the principles and application of his apparatus, which were evidently apprehended and appreciated by the Prince with characteristic readiness.—*The Times.*

---

*Experiments with Self-acting Railway Signals.**

The self-acting signals are being adopted on French lines. *Galignani* speaks of an experiment made in presence of a commission on the Bordeaux and Test railway. The invention consists of mechanisms placed on the external edge of the rails, and united together by an electrical wire, which gives the signal of the arrival of the train on a curve or in a tunnel. The apparatus may be established in such a manner as to act not only at a distance of 700 metres, but even 3000 metres. The passage of a train on entering on a curve or on approaching a tunnel causes, by the pressure of the springs of the apparatus, the explosion of petards, which are heard at a great distance, and at some moment moves a colored disk, which gives the signal to the approaching train to stop.

* From the London Builder, January, 1854.

AMERICAN PATENTS.

List of American Patents which issued from May 2d to May 23d, 1854, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

MAY 2.

1. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"What I claim is, forming seams for stitching and sewing with two threads, the first of which is carried through the cloth at each stitch, and interlaced with the second by forming a loop with the second on one side of a loop formed with the first, and then forming a second loop with the second thread, which is drawn through the loop formed with the first thread, and through the first loop formed with the second thread, as described. Also, the needle and looper, in combination with the instrument, or its equivalent, for carrying or guiding the second thread within the range of the looper, substantially as described."

2. For an *Improved Method of Discharging Cargo from Canal Boats;* Amos Young, Georgetown, D. C.

Claim.—"I do not claim as new, of themselves, any of the devices named; but I do claim the method described, of discharging and transferring coal or cargo from canal boats, by causing the boat to free itself of its cargo by the settling or falling of the boat in the dock in drawing off the water from the latter, in such a manner that the cargo contained in one or more cargo boxes or trucks provided with suspension truck attachments or devices, as specified, is left suspended at its draft or floating level in the canal, on a suspension track or railroad built on the sides of or over the dock, whereby the cargo may be discharged from the boat with despatch, and with but little labor, and be run off at a high level to any distant place of transfer, and there be transferred from one receptacle to another without inconveniently detaining the boat, and whereby the many other advantages specified are obtained; the said cargo box, with its suspension truck attachments or devices, boat dock and suspension track or railroad, being arranged and operated together, as set forth, and the whole serving to economize time and labor, and reduce the cost of transit and delivery at a high level, in a practicable manner."

3. For an *Improvement in Certain Devices for Tonguing and Grooving Lumber;* Nicholas G. Norcross, Lowell, Massachusetts.

Claim.—"I am aware that a rotary planing cylinder has been arranged so as to have its cutter knives rotate in the direction in which a board was moved against it, and in such case a bar, or the equivalent therefor, has been employed to keep the board down upon the bench, when the cylinder has been arranged in the bench or under the surface of board dressed by it; I therefore lay no claim to any such disposition or operation of a rotary planing cylinder for planing boards, as the function of it is different from that of a rotary saw, the latter being made to cut entirely through a board, while the former only dresses it on one side of its surfaces, and cuts but a short distance below the same. The saw cuts into two opposite surfaces, or through the board, and in striking out of the board it leaves a ragged edge on the surface, while in striking into it the surface through which it enters is left smooth and without a ragged edge or fin. Now, as one of the sides of the board to be tongued and grooved is usually a planed surface, and that surface must be placed downwards on the bench during the operation of making the tongue and groove, it becomes desirable to have it jointed with a smooth edge, and this is done by making the teeth of the saw to run so as to cut into the surface of the board, instead of cutting out from the board and such surface. And I do not claim the improvement of making the tongue with two recesses, the same being accomplished by means of the extension of the teeth of the saws inward beyond the knives, as stated, but mean to claim such an arrangement of the teeth of the saws with respect to the cutter knives, and for the purpose of making the tongue and such channels or recesses. I also claim the mode of confining the upper saw or set of saws of either the tonguing or grooving cutters to its shaft, viz: by the combination of the two right and left threaded screws and the screw nut, the same being substantially in manner and for the purposes of ready adjustment of

the saw or saws, as stated. Also, the improvement of making one or both of the draft rollers with a groove, when such roller is arranged and made to operate with respect to the tonguing cutters or saws, as specified."

4. For an *Improved Device in Constructing Strap Iron Railing;* Matthias Lachenmaier, Philadelphia, Pennsylvania.

Claim.—"What I claim is, the manner described, of constructing and fitting together crimped wrought metal railing, by constructing the cross bars at the extremities of their crimps or bends with punched or pressed studs projecting, either successive pair in each bar, in opposite directions alternately, to form supports or stops to the bars on either side of their crimps, and on both sides or faces of the railing, to prevent the bars from slipping out of their crimped bearings, or from out of line with them; also, to relieve the crimps from injurious strain, and to divide strain, jerk, or pressure applied to the railing, or to one or more bars, over the several bars, whereby time and labor are economized in fitting together the railing, a simple and strong double cross-tie of the bars at their several crimps is obtained, and whereby a flatter crimp, without the usual adjuncts of bolts or rivets for tying the bars together, may be used, as specified; the said cross bars at one of their crimps or bends either being made with or without a centre stud fitting into a corresponding indentation in the adjoining bar, to serve as a starting point or centre for fitting the bars together, and to hold them in their crimps, substantially as specified."

5. For an *Improvement in Chargers for Fire Arms;* Wm. M. Storm, City of N. Y.

Claim.—"There are several 'chargers' already in existence, as Colt's 'powder and shot chargers,' and others; but I disclaim all interference with these, claiming in my charger the general arrangement of the parts, substantially as described, the same embracing the combination of the devices of a fixed rammer and moving ball nozzle, and with the latter of a plurality of ball columns, or distinct chambers, the whole operating as set forth."

6. For an *Improvement in Plates for Artificial Teeth;* Mahlon Loomis, Cambridgeport, Massachusetts.

"My invention consists in making whole sets, or the upper or lower halves or parts of sets of artificial teeth, all of porcelain; a half set consists of but one piece of material, there being no metallic plate, as in the usual way, but the same material of which the teeth themselves are made is used instead of a metallic plate."

Claim.—"I do not claim the process above set forth; in making sets of artificial teeth, I do not claim the spreading of a gum enamel over one side of a metallic roof plate upon which the teeth are fastened; nor the extension of the porcelain gum some way, and not entirely upon the roof; but what I claim is, the manufacture of whole or half sets of porcelain or mineral teeth, substantially as described."

7. For an *Improvement in Reed Boxes for Musical Instruments;* Mervin T. Lundfear, Manchester, Connecticut.

Claim.—"What I claim is, 1st, My method of inserting reed boxes in chambers of graduated length and depth and width, as described. 2d, Tubing or chambering the reed boxes, as described. 3d, Blocking the reed box and mortising the block when it overlies the locality of the reed, as described."

8. For an *Improvement in Processes for Distilling Rosin Oil;* Halvor Halvorson, Assignor to H. Halvorson and J. T. Heard, Boston, Massachusetts.

"It has been common in the distillation of rosin to mix it with alkalies, alkaline earths, or metallic oxides; also, that rosin and oil have been distilled from bricks and various other insoluble matters; I therefore do not claim any such mixtures of rosin for the purposes of distillation, as they do not have a specific action in the process that results from the employment of clay. I have found that in the use of clay, no pitch residuum is left in the retort or distilling vessel after distillation; whereas, with any of the other matters above alluded to as having been mixed with rosin, I have found a large residuum of pitch remaining after distillation. The clay, therefore, I have discovered to have, in some unknown manner, a specific action on the rosin in preventing the formation of the pitch residuum."

Claim.—"What I claim is, the combining clay with rosin, and subjecting the mixture to distillation, so as to produce therefrom an oily product, substantially as specified."

9. For an *Improvement in Distilling Apparatus;* Halvor Halvorson, Assignor to H. Halvorson and J. T. Heard, Boston, Massachusetts.

Claim.—"What I claim is, the rotary cup, the rake, and the discharge pipe, (made with a plexure,) or their equivalents, in combination with a still, and made to operate therewith, substantially as specified."

10. For an *Improvement in Spinning Cotton;* John W. Adams, Thompsonville, Conn.

"The nature of my invention consists in interposing between the spindle or bobbin or spool thereon, and the flyer, traveler, or cap, or the equivalent thereof, a carrier or carriers moving with the spindle, bobbin, or spool, over which the thread passes from the flyer, traveler, or cap, to the spindle, bobbin, or spool, so that the dragging or drawing of the flyer, or traveler, or thread, on the edge of the cap, shall be effected by the said carrier or carriers, the thread being in contact therewith, so that the power and the resistance shall at all times be at the same distance without reference to the varying of the winding diameter."

Claim.—"What I claim is, the employment of the thread carrier, substantially as specified, in combination with the central spindle for winding on with or without a bobbin or spool, and with the ring, groove, and traveler, or its equivalent."

11. For an *Improvement in the Couplings of Endless Chain Horse Powers;* Wm. E. Arnold, Rochester, New York.

"The nature of my invention consists in making the platforms or treads of grooved or fluted metallic plates, the grooves running crosswise, so that they shall form rack teeth to work into and drive the pinion; and also in the lip and groove and hooks on the platform for making the continuous chain, without using links, pins, or any rigid connexion between them."

Claim.—"What I claim is, the lips, the recesses, the hooks by which the series of platforms are united into a continuous chain platform, without any other fastenings than those afforded by their own peculiar shape, and thus avoiding the use of links, bolts, rods, or similar fastenings, substantially as described."

12. For an *Improvement in Operating Catches in Tool Holders;* John Allender, New London, Connecticut.

Claim.—"What I claim is, the face plate with an eccentric groove or slot, in combination with the sliding catch, with a projection fitted to said groove, and so arranged as to traverse the catch by turning the plate, substantially as described."

13. For an *Improvement in Making Ships' Knees;* William Ballard, City of N. York.

"The nature of my invention consists in the formation of ship knees of bent pieces of timber, with the convex surface so combined with the concave surface of an angular piece as to support the bent piece, and prevent it from straightening, and at the same time form an angle to fit between the beams or parts of the vessel to be supported by knees. Such knees may be formed from straight pieces of timber by bending, and two knees may be formed from one piece, and thus the knees be connected together by the same piece intermediate with the bent parts; and the knees may be formed to a square, in-square or out-square, as desired."

Claim.—"What I claim is, the formation of ship knees, substantially as above described."

14. For an *Improvement in Hydraulic Heaters;* Wm. H. Churchman, Philada., Penn.

Claim.—"What I claim is, the attachment of all of the radiating or circulating tubes, in one or more series of rows, directly to the boiler or main receptacle for water, together with any and all equivalents thereof."

15. For an *Improvement in Adjusting the Packing of Pistons for Steam Engines;* J. Crabtree, Philadelphia, Pennsylvania.

"The nature of my invention consists in a peculiar mode of constructing and applying to the piston of an engine, a small open conical ring between two lugs cast on the inside of the main inner ring, so that by turning an adjusting screw bolt, (whose outer end projects through the cover of the piston,) the packing rings can be properly adjusted (tightened or loosened) without taking off the cylinder head, by means of a wrench or other suitable instrument, to be passed through an appropriate hole in the cylinder head or cover."

Claim.—"I do not claim the packing rings, concentric with and clasping the inner rings, nor the inner ring and packing rings in combination, nor adjusting the packing of pistons through a hole in the cylinder head; but what I claim is, the open conical ring, in combination with the lugs, or their equivalents, cast on the open inner ring, and the flanched adjusting screw, or its equivalent, the shorter adjusting screw and follower, arranged and combined substantially as described."

16. For an *Improved Means for Adjusting the Valves of Locomotive Engines;* Henry W. Farley, East Boston, Massachusetts.

Claim.—"I do not claim making use of the power of the locomotive, exerted through rollers placed beneath the rails, for the purpose of driving machinery, pumping, sawing, or performing other analogous operations; but what I claim is, the method of adjusting the valves of a locomotive engine, the drivers being revolved by rollers suitably placed to receive them, which rollers are driven by any suitable power, independent of the engine itself."

17. For an *Improved Cutter for Metallic Bars and Rods;* John Gallagher, City of N. Y.

"The nature of my improvements consists in providing as simple and efficient means for cutting bolts, nuts, &c., as is obtained by the use of shears for cutting metallic plates, it being well known that they are not adapted for the purposes to which my improvements refer; and in the construction of the machine described, simplicity and durability are combined, thereby affording a cheap and expeditious mode of accomplishing the object."

Claim.—"What I claim is, the arrangement of the movable cutting die in the eccentric lever, operating in connexion with the fixed cutter, as described."

18. For an *Improved Machine for Making Bed Pins;* Curtis Goddard, Edinburgh, O.

Claim.—"What I claim is, the combination of cutters in the hollow mandrel with the movable cutter operated by the pin pressing the cutter, or by a disk of metal moved by the pin, or other means substantially as set forth."

19. For an *Improvement in Straw Cutters;* Robert Hodgin, Barnesville, Ohio.

Claim.—"I disclaim the use of an endless belt for the purpose of feeding the straw or other material to the knife; but what I claim is, the straw rest for supplying the straw to the knife, said straw rest or rack being carried the entire length from rear to front end of the cutter box by an intermittent forward motion, as set forth."

20. For an *Improvement in Car Trucks with Adjustable Axles;* Archibald C. Ketchum, City of New York.

Claim.—"What I claim is, the combination of the sliding side pieces, the transverse sliding bar, and the lever, in the manner substantially as described, for the purpose of causing the axle boxes to move in such a way as to make the axles assume the form of radii or normals to the curve, and thereby keep the wheels in line with the track."

21. For an *Improvement in Trunk-Lock Hasps;* Conrad Liebrich, Philadelphia, Pa.

Claim.—"What I claim is, 1st, The so combining of a spring with a hinged hasp as that the lower or hinged portion thereof shall stand off from the trunk, substantially as described. 2d, The placing of the hasp catch in a solid projection, which enters the lock with the hasp catch, and takes all the strain incident upon the tendency of the lid to open, and thus protect the catch itself, substantially as described."

22. For an *Improvement in Harrows;* Washington F. Pagett, Stone Bridge, Virginia.

Claim.—"What I claim is, 1st, The constructing harrow beams of sections of iron, with the teeth wrought solid upon and with them. 2d, The combination therewith and arrangement of cross-rods with screw and taps, and pipes or tubes, or their equivalents, to keep the beams and sections in their places."

23. For an *Improved Arrangement of Spring Dies in Machines for Making Clinch Rings;* G. M. Patten, Bath, Maine.

Claim.—"I am aware that a lower die having a spring seat for discharging the manufactured article has before been used; also, that a spring clearer, differently arranged or operating in combination, has been employed in various eyelet machines for removing the eyelets from the punch or upper die as it ascends; such, therefore, I do not claim; but what I do claim is, the spring seat of the lower die and elastic clearers, when arranged and operating together, as specified, so that not only is the finished clinch ring forced

upwards out of the lower die, and detached from the upper one to permit of its easy removal by the bar in feeding forward, but also whereby the spring seat and clearer are made to act as elastic grippers to the ring, to hold or keep it in its seat till removed by the bar, to avoid breakage of the machine, and whereby the clearer serves as an elastic guide to the bar, to facilitate the entry or feed of the bar, and to keep it in a fair or flat position for the operation of the punch upon it, as specified; the said clearer and spring seat being hung and operated so as to exert a continual tendency to approach each other, both during the up and down stroke of the punch, as set forth."

24. For an *Improvement in Flexible Harrows;* Wm. B. and G. M. Ramsay, South Strabane, Pennsylvania.

"The nature of our invention consists in constructing a flexible harrow of three separate parts or squares, and making said squares of such proportions, and arranging them in such relation to each other, that one of their diagonal lines will run parallel to the line of travel, and the other transverse thereto, whereby we are enabled to obtain a greater breadth of sweep than is secured with a harrow composed of four parts, and arranged and joined together in the ordinary way, and also to connect the whole together by three hinges or flexible joints, arranged in the position of a right angle triangle, by which position we secure a greater freedom and diversity of motion than can be obtained by any other position of the same number of flexible joints or hinges."

Claim.—"What we claim is, the peculiar arrangement described and shown in the drawing of the three parts of the harrow and the three flexous joints connecting the same together, in combination with the construction of said joints, which allows of the several parts very freely and perfectly adjusting themselves up and down, independent of each other, in passing over the undulating surface of the soil, substantially as described. By thus arranging and combining the several parts of the harrow, we are enabled to simplify its construction, lessen its cost, and render it capable of making ten more movements than any other flexible harrow known, and consequently performing the harrowing operation more perfectly and speedily."

25. For an *Improvement in Machinery for Making Rope;* Wm. Robinson, Jr., Warsaw, New York.

Claim.—"What I claim is, 1st, The employment of the cogged ring, arranged and operating as described, for giving the flyers their independent rotation for twisting the strands, and by its own revolution regulating the amplitude of that twist. 2d, The employment of the rotary clamps, in combination with the cams and springs for grasping, conveying, and releasing the rope, as set forth."

26. For an *Improvement in Violins;* Sewall Short, New London, Connecticut.

"The nature of my invention consists in uniting or combining a metallic horn or trumpet with a violin, violoncello, bass viol, or instrument of a similar character, by which means the vibrations of the latter are greatly increased, and the tone and power of the instruments much improved."

Claim.—"What I claim is, the application of a trumpet or horn to violins, bass viols, and other similar instruments, in the manner described."

27. For *Improvements in Air Engines;* Philander Shaw, East Abington, Mass.

"The nature of my invention consists, firstly, in the employment of auxiliary heaters, which are so connected together and with each other, by means of valves, that the air for the supply of the engine shall be pumped in against the minimum pressure within the main heater, while it is worked off at the maximum pressure. Also, in passing the exhaust air from the cylinder, together with the smoke and heated gases from the furnace, through the auxiliary heaters in one direction, while the air for the supply of the engine is caused to pass in the contrary direction through tubes within these auxiliary heaters, by which means the heat is extracted from the exhaust air and smoke, and transferred to the air on its way from the air pump to the heater."

Claim.—"What I claim is, the auxiliary heater, constructed and arranged as set forth; the exhaust air and the products of combustion being passed through in one direction, while the cold air from the force pump is passed through in the other, by which means the heat is extracted from the heated air and smoke, and transferred to the cold air on its way to the engine, the latter being pumped in against a pressure much less than that at which it is worked off from the main heater, as explained. 2d, I do not claim the use of cold water for the purpose of refrigerating the cylinder or piston of hot air or other engines; but what I do claim is, the arrangement described, of the tubes within the piston rod, the reservoir, and the india rubber tubes."

28. For an *Improved Hydrodynamic Engine;* Le Grand C. St. John, Buffalo, N. York.

"The object of my invention is, to furnish the means of bringing into effective action the force passed by water in its rise and fall; it consists in the employment of a float connected by mechanism with the apparatus for letting the water to and from the chamber in which the float operates, together with mechanism for changing the motion produced by the rise and fall of the float with a continuous rotary motion."

Claim.—"What I claim is, the described arrangement of mechanism for operating the tube, so that it shall produce the alternate opening and closing of the ingress and egress passages, for letting water to the float, and drawing off the same, substantially as set forth. Also, the arrangement of the wheels, with their respective shafts and ratchets and pawls, for causing a continued rotary motion of the wheels, from the alternate motion of the float, substantially as specified."

29. For *Milker's Protector;* John M. Weare, Seabrook, New Hampshire.

"The object of my invention is to enable a milkmaid or person while milking a cow to secure the tail of the animal, so as to prevent it from being whisked about, or in other words, to prevent the cow from striking a person with her tail, an occurrence which is very common, and of great annoyance to those who perform the operations of milking."

Claim.—"I claim the combination of hamstring and tail nippers, applied together and made to operate essentially as described."

30. For an *Improved Rotary Planing Knife;* Elbridge Webber, Gardiner, Maine.

"The nature of my invention consists in combining peculiarly formed knives with oblique elliptical cutter stocks, and in arranging the same for the purpose of planing lumber."

Claim.—"What I claim is, the combination of the knives with the stock, constructed, arranged, and operated substantially as set forth."

31. For an *Improved Expansion Bit;* Asa Weeks, South Boston, Massachusetts.

Claim.—"I do not claim an expanding bit, nor making both of the cutters capable of motion, independent of each other; but what I claim is, the motion described, of connecting the two cutters with each other, so that they shall move out and in simultaneously and equably, as set forth."

32. For an *Improved Slotting Machine;* Parley Williams, 2d, Barre, Mass.

Claim.—"What I claim is, 1st, The mandrel, secured in the top of the column which supports the hub, serving with the aid of a key to hold the hub in place, and containing a slot on the side in close contact with the hub, which serves as a guide for the tool while cutting the slot in the hub, or other similar article, substantially as described. 2d, The combination of the wedge, the screw, and the spring, the wedge being placed in a recess in the mandrel behind the tool, and serving to feed and hold the tool to its work, the screw being attached to the wedge so as to bear on the top of the mandrel, and control the descent of the wedge, and the spring being attached to the tool so as to bear on the hub, and hold the tool back against the wedge, and thus prevent it overloading itself, all substantially as set forth. 3d, Attaching the tool to its stock by a button or knot at the bottom of the tool, fitting loosely into a slot in the top of the tool stock, which has a mouth narrower than the button, but which extends only partly across from the front of the stock, said slot being arranged in such a direction, and its narrow mouth being of such length as to allow the tool, while attached to the stock, to move back and forth as far as is required for the feeding operation, but to allow the tool to be withdrawn by moving it back beyond its most backward operative position, as set forth."

33. For an *Improvement in Hay Knives;* Seth Whalen, West Milton, New York.

Claim.—"What I claim is, attaching a blade made of sheet steel, and bent at its upper extremity so as to stand out from the handle, directly to and in the centre of the handle, and between the arms, whereby a great saving in time, labor, and expense in making hay knives can be effected, and an equal distribution of the power of the operator exerted in a perfect manner upon the edges of the knife, and it consequently caused to act more effectually upon the hay than the ordinary knife, substantially as set forth."

MAY 9.

34. For an *Improvement in Sewing Machines;* Simeon Coon, Ithaca, New York.

Claim.—"I claim the combination of the slot in the shuttle, and the pin or stud in the race way, or their equivalents, for the purpose of drawing the thread from the shuttle

bobbin, so that there may be an uniform tension upon the shuttle thread when drawing up the stitch, substantially as described. Also, in contradistinction from the double acting dog or pawl and ratchet, which changes the time of feeding forward the cloth relatively in regard to the motion of the needle, the separate pawls operated by a cam and levers, or otherwise, so that the feed, whether reversed or not, shall always remain relatively the same with regard to the motion of the needle, or so that the feed shall take place whilst the needle is going down or towards the cloth, and not when it is leaving the cloth to draw up the stitch, substantially as described."

35. For an *Improvement in Machinery for Dressing Flax;* E. L. Norfolk, Salem, Mass.

"My invention consists in a certain device for regulating the movements of the rollers which supply the flax to the machine, whereby the said rollers are made to feed the material at a speed corresponding inversely with the quantity passing between them, or to stop entirely when the quantity becomes so great as to render a stoppage necessary."

Claim.—"I do not claim the employment of trunks with movable lids, by the rising and falling of which the rate of feed is regulated; but I do claim governing the movements of the rollers which supply the material to the machine by means of wedges, which are suspended in such a way as to be caused by the rising and falling of the movable lids, or their equivalents, to rise and fall, and thus regulate the position of bars which are acted upon by eccentrics or cams for the purpose of transmitting motion to the feed, and thereby regulate the amount of motion which the said bars receive from the said eccentrics or cams, substantially as set forth."

36. For an *Improvement in Bee Hives;* Clark Wheeler, Little Valley, New York.

Claim.—"I do not claim either the box, the pendent valves, or reticulated screen, separately, or independent of each other, as they have been used before in moth traps; but what I do claim is, the drone trap, constructed as set forth, and operating in the manner described."

37. For an *Improvement in Sewing Machines;* Herman Crosby, Jr., Watertown.

Claim.—"I claim, 1st, The adjustable cam, or its mechanical equivalent, in combination with the friction brake, for the purpose of intermitting the action of the brake upon the thread during the feed, and thus obviating the danger of sundering the thread in rapid work during that movement of extreme tension, as set forth. 2d, Enlarging that portion of the needle which, having entered the material, is to retire from it before the pull upon the last loop is commenced, in the manner and for the purpose described."

38. For an *Improvement in Sewing Machines;* Christopher Hodgkins, Assignor to Nehemiah Hunt, Boston, Massachusetts.

Claim.—"I am aware that there is nothing new in moving the feeding wheel by means of a friction brake, knuckle, or clamp, and a lever combined therewith; I am also aware that for the purpose of operating a feed wheel, a combination consisting of a shaft with two arms, a screw regulator, a lever and clamp have been used; I therefore do not claim such devices; but I do claim the peculiar manner in which the brake clamp is constructed, applied to, and made to operate in the groove of the feed wheel, whereby the bearings of the clamp on the two opposite concentric surfaces of the groove, are curved concentric lines or surfaces, running parallel, or about parallel to the plane of the feed wheel, instead of perpendicularly to it, such an arrangement of the bearing lines or parts of the clamp rendering its hold on the wheel far more certain than when they are made in length only equal to the depth of the groove, and to stand perpendicularly to the plane of the feed wheel. I also claim the mode of operating the brake clamp or lever, or in other words, the arrangement and combination of the spring, the slide, cams, the lever, and the spring, as set forth, such mechanism causing the clamping of the lever brake to the feed wheel to be wholly done by mechanism, acting entirely before and separate from and not controlled by that which produces the movement of the clamp, by which corresponding extent of motion is produced in the feed wheel."

39. For an *Improvement in Sewing Machines;* Otis Avery, Honesdale, Pennsylvania.

Claim.—"I claim the so arranging the upper needle bar on a pivot, and controlling it by a spring, or their equivalents, as that it may be swung around to remove or replace the cloth, or other material to be sewn, substantially as described. Also, the arrangement and combined adjustment of the two needles, for the purpose of regulating the relative positions of said needles to each other, and their joint positions in relation to the

material to be sewn, substantially in the manner described. Also, the arrangement of an adjustable table or support for the cloth, with regard to two needles which have a fixed centre at which the stitch is formed, as that by raising and lowering said table, or the cloth, the stitch may be thrown to one side or the other, or in the centre thereof, substantially as described."

40. For an *Improvement in Seed Planters;* George T. Enoch and Daniel Wissinger, Springfield, Ohio.

"The nature of our invention consists in the method of adjusting or regulating at pleasure, the several parts for furnishing the proper quantities of seed to be sown."

Claim.—"We claim the mode of adjusting the tappet wheel, in combination with the peculiar form of the sliding bar, to suit the nicest differences in any desired quantity of seed to be sown, substantially as described."

41. For an *Improved Hub Borer;* William J. Casselman, Vernon, New York.

Claim.—"I claim boring taper holes through hubs by means of a lever, secured by a pivot to a rod, which is drawn through the mandrel hole of the hub, said lever having a cutter at one end and a pin at the opposite end, which pin fits in an oblique slot in an adjustable plate; the slot giving the proper movement to the cutter as it passes through the hub, as described."

42. For an *Improved Extension Bit Guard Key for Door Locks;* William Damerel, Brooklyn, New York.

Claim.—"I am aware that the key hole has before been plugged on the outside by the key from within, by means of an additional or swivel guard bit in front of the ordinary or main bit which operates the bolt; such, therefore, I do not claim; but I do claim so arranging and connecting the main bit of the key, or that portion which operates the bolt, with the shank of the same, as that the main bit may be thrown in or out of gear at pleasure with the shank, and extended so as to plug the key hole, or be moved inwards to form a firm connexion with the shank to operate the bolt, substantially as set forth, and whereby the many advantages specified are obtained."

43. For an *Improved Felloe Machine;* Heman H. Dean, Adrian, Michigan.

"The nature of my invention consists in the employment of a combination of devices for removing the concave felloe guide from the cutters, and also for regulating the approach of said guide and felloe to the cutters."

Claim.—"I do not claim the cutters, clamps, or guides; but what I do claim is, the combination of mechanism operating the guide, namely, the lever, rod, and springs, arranged and operating substantially as set forth."

44. For an *Improved Pump;* Jacob Edson, Boston, Massachusetts.

Claim.—"I claim, 1st, The tube, in combination with the air chamber, constructed and operating in the manner set forth. 2d, The cup, in combination with the holes and the packing, constructed and applied to a force pump, as described. 3d, The inclined partition in the rear of the spout, operating in the manner set forth."

45. For an *Improvement in Cultivators;* Chas. K. Farr, County of Hinds, Miss.

"My invention consists in the employment of a bed with sides inclining upwards and outwards, connected with the beam and handles of the implement, to the front of which is fastened an adjustable coulter; the object being to prevent the earth from falling into the furrow by the pressure of the sides of the bed, as the plough moves forward."

Claim.—"What I claim is, the bed with inclined sides, as described, which following the trace of the coulter, renders the sides of the furrow compact, and prevents the falling in of the earth, substantially as set forth.'

46. For an *Improvement in Bridges;* Albert Fink, Baltimore, Maryland.

"The nature of my invention consists in combining different systems of triangular bracings, in the manner described, so that a weight coming on one of the systems of the truss is not only carried over one or more other systems before it is carried back to the abutment, but the foot of the post of each triangle shall be capable of settling vertically, or moving to the side, so that the tension rods of each system of the triangular bracing will be strained equally when the bridge settles under a superincumbent weight."

Claim.—"I do not claim as new, the manner in which the central post is supported; nor do I claim the combination of a series of triangular bracings in such a manner that

one system of triangles is supported by and dependent on the other, merely, as I am aware that this has been done before, both in trusses for bridges and roofs; but what I do claim is, the method of combining the different systems of triangular bracings described, so that a weight coming on one of the systems of the truss, is not only transferred over one or more other systems before it is carried back to the abutments, but the foot of the post in each triangle being unconnected with the tension rods of the other triangular bracings, can settle vertically, as well as move to the side, so that the tension rods of each system of the triangular bracings will be strained equally when the bridge settles under a superincumbent weight. This would not be the case if the foot of the post in the second system of triangular bracings rested on the tension chord of the post in the first system, as heretofore used, and herein consists my improvement."

47. For an *Improved Journal Box for Saw Mill Carriage;* Chas. R. Fox, Chicago, Ill.

Claim.—"I claim the construction of the boxes with the opposite inclined inner faces for giving the requisite set off to the carriage when gigging back, and again setting up when moving forward for the cut, substantially as set forth."

48. For an *Improvement in Machinery for Cutting Paper;* Nelson Gavitt, Phil., Pa.

"The object of my invention is to give to the machine the capacity of varying the length of the sheets cut from the web to any degree, small or great, within the two extremes of length to which the machine is adapted, and to produce such changes while the machine is at work."

Claim.—"I am aware that conical rolls encircled by a shifting belt, as a device for varying the relative velocity of different parts of a machine, has long been known, and I do not claim it; but I do claim the method, substantially as described, of adjusting the cutting of sheets from a web of paper, whereby the length of the sheets can be varied by any required proportionate amount of the whole range of variation to which the machine is adapted, however small or however large the same may be, thus rendering it possible, with continuous feed of the web of paper under an intermittent cutter, to sever the sheets half way or thereabouts, between water marks, nearer together at one part of the web than at another."

49. For an *Improved Arrangement of the Pestle with the Mortar;* Platt C. Ingersoll, Elmira, New York.

"The nature of my invention consists in combining the pestle with the mortar by means of a ball fitted to a corresponding cavity in a spring bar connected with the mortar. And also, in connecting the universal joint in which the pestle works with the mortar, by means of a spring bar, the said bar being so connected that if desired, it can readily be attached or detached."

Claim.—"I claim the manner of arranging and combining the pestle with the mortar by means of the ball on the handle of the pestle, fitted to a corresponding cavity in a spring bar, substantially as specified."

50. For an *Improved Method of Unloading Canal Boats and other Vessels;* William Longbridge, Weverton, Maryland.

Claim.—"I am aware that vessels have been made with valves or traps in their bottoms, for the discharge of their loads of earth, mud, &c., as in the case of J. R. Putnam's patent of May 6th, 1841, and the withdrawn case of Sophia Putnam, of June 28, 1847; I am also aware that vessels have been floated into dry docks, and the water drawn off through valves, leaving the vessel dry and supported upon blocks or upon trucks; I therefore do not claim either of these devices, or in that of the shute; but what I do claim is, the method or process of unloading vessels described above, by means of the combined arrangement of the vessel with valves in the bottom, the dry dock with valves immediately below those in the vessel, and the shutes to carry off the load into boats or other receptacles placed below, but not immediately under the elevated dry dock, all as described."

51. For an *Improved Manure and Sand Loader;* Horatio G. Marchant, Annisquam, Massachusetts.

Claim.—"I claim the transportable manure loader, consisting essentially of the following elements in combination, viz: the body or box, the trough, and the rake, constructed and arranged substantially as described."

52. For a *Machine for Reducing Wood to Slivers;* Jonathan Prescott and George W. Prescott, Boston, Massachusetts.

Claim.—"We claim the arrangement of the planes, so that each shall cut not only

with a drawing stroke, but shall curl the shavings in helices, as specified. And, in combination with the feeding carriage and the feeding screen, we claim the movable straddle or sliding block, and the scroll cam of the screw, the same being made to operate together, substantially as specified. And we claim the tripping rest as combined with the weighted lever and the feeding carriage, and used as specified."

53. For an *Improvement in Bleaching Apparatus;* J. Augustus Roth and Joseph Lea, Philadelphia, Pennsylvania.

"The nature of my improvement consists in so arranging a series of rollers in a vat that a considerable number of continuous strips or sheets of cotton or linen fabric may be simultaneously drawn through the vat, said fabrics being fully spread out. The advantage of the improvement is, that the fabric may be thoroughly acted upon by the bleaching or boiling solutions, with a great saving in time and expense over the ordinary method."

Claim.—"We do not claim the arrangement of rollers in a vat, generally; but what we claim is, the arrangement of the series of graduated and compensating upper and lower rollers, in combination with the vat, for the purpose of treating simultaneously a series of parallel layers of woven fabrics, in the manner substantially as described."

54. For an *Improved Machine for Marking Out Sash;* James Rogers, Poultney, Vt.

"The nature of my invention consists in setting out the heads of the mortises in sash or other small work, with two or more mortises in each piece, and two pieces at the same time, and upon both sides with the same motion."

Claim.—"I claim the movable knives or markers, movable stops and sliders, their equivalents, and manner of adjusting the top, and of causing markers in the top to correspond with the bottom markers, and manner of applying the scales to the machine, substantially as set forth."

55. For a *Machine for Weighing and Printing Butter;* William S. Reinert, Philadelphia, Pennsylvania.

Claim.—"I claim the combination of the mould or vessel for containing the butter, suspended to the lever or scale beam, and its attachments, plunger, or piston, having the desired configuration on its lower surface, and upright rod and button for raising the circular plate or piston in the bottom of the said vessel or mould, together with the levers for operating the same, for weighing, forming, and branding, or imprinting with any desired configuration, the butter in parcels, and discharging the same from the vessel or mould, substantially as set forth."

56. For an *Adjustable Flue Bottom of Steam Boilers;* Alexander M. Sprague, Mobile, Alabama.

Claim.—"I claim the movable adjustable bottom of the flue space under the boiler or boilers, so constructed and arranged that it may be raised and lowered, or adjusted to graduate the size of the flue under the boiler or boilers, and adapt such flue to the kind of fuel used, substantially as described. Also, in connexion with the above-mentioned movable adjustable bottom, the inclined vibrating piece or bridge, or its equivalent, so constructed and arranged that it will operate with the bottom, and conduct the flame from the furnace into the flue under the boilers, substantially as described."

57. For an *Improvement in Pistons for Steam Engines;* Alexander M. Sprague, Mobile, Alabama.

Claim.—"I claim making the body of the piston in two parts, substantially as described, so that the hub and disk or body, or centre portion of the piston, can be removed, with the piston rod, in the same direction that the follower or cap is taken off, and replaced, without removing the outer portion or barrel and flanch that supports the packing."

58. For an *Improvement in the Construction of Hatches;* Daniel Tallcot, City of N. Y.

"The nature of my invention consists in attaching to the axis or pivot of each door of the hatch a half pulley, to which a lever is connected by a chain or rope, said lever being so constructed and arranged that the carriage, in its descent, will operate upon said levers and open the doors, allowing the carriage to pass through them; the doors, after the carriage has passed through them, closing by their own gravity; the falling or closing of the doors being graduated by means of springs."

Claim.—"I claim causing the doors of the hatch to be elevated or raised as the carriage descends, by attaching to one of the pivots of each door a half pulley, which is connected by a cord to a lever, said levers having curved arms, which project a short distance beyond the edge of one of the uprights, so that they may be operated upon by one of the rollers, the doors being counterpoised by the spiral springs, or their equivalents, as set forth."

59. For an *Improved Arrangement of Friction Roller in Inclined Plane Hinges;* Enoch Woolman, Damascoville, Ohio.

Claim.—"I claim making and arranging the roller so that it can be traversed towards and from the pivot of the hinge, in combination with the scores in the inclined planes, so that it can be used either as a self-shutting or self-retaining, when open or partially open, substantially as described."

60. For an *Improvement in Locomotive Fire Box;* Ross Winans and Thomas Winans, Baltimore, Maryland.

Claim.—"We claim the downward and rearward inclination of the top or roof, when this is connected with the flat grate surface and the usual feeding hole or door, and with or without the fuel feeding boxes through the roof, as set forth."

61. For an *Improvement in Screw Jacks;* Francis Davis, Keene, Assignor to J. Mason Reed, Swansey New Hampshire.

"My invention consists in the use of a right and left screw with the head or sockets for the operating lever between them, whereby the latter is removed to an equal distance from the top and bottom ends of the jack, and the motion of the head of the jack is double that of the ordinary screw jack for an equal motion of the operating lever, and in an equal space of time, by which means a great saving of time and power is effected."

Claim.—"I do not claim the use of a right and left screw, as this has been made use of before; nor constructing a screw jack entirely of iron; but I do claim as a new tool or instrument for the purpose of raising heavy bodies, the above described jack, constructed and operating in the manner set forth."

MAY 16.

62. For an *Improved Clap Board Joint;* Wm. Baker, Utica, New York.

"The nature and principal object of my invention is, so to construct and form the boards for the siding of houses, that in putting them together and nailing them to the frame of the building, the heads of the nails may be covered, while, at the same time, the chief characteristic of clap boarding, the overlapping of one board upon another for shedding the water, shall be preserved."

Claim.—"I claim the combination of the lock in the rear of the joint with the extended lip in front, constructed and used in conjunction for the purposes of effecting the objects of the invention, as specified, the whole being constructed, combined, and arranged substantially in the manner set forth."

63. For an *Improvement in Harvester Rakes;* Cyrus Roberts, Bellsville, Illinois.

Claim.—"I claim the fingers, arranged as described, and operated by means of the eccentric rod and lever, in combination with the fork, constructed and arranged with a curved slot through it, in which the pin or arm fits, and operated by the crank, for the purpose of removing the cut grain from the platform."

64. For an *Improved Lath Machine;* Hiram Frisbee, Olmstead, Ohio.

"The nature of my invention consists in hanging the log upon centres, in a carriage which moves the length of the log backward and forward on a frame, in which revolve circular saws at right angles to each other, for the purpose of cutting off the lath from the log as it traverses over the saw. Also, in the combination of devices for adjusting the log to the saws, so that lath or strips of any desired thickness or width may be cut from the log, and also in revolving the log by the action of a ratchet, the thickness of a lath, immediately on each strip or lath being cut from the log."

Claim.—"I claim the combination of the movable cam block, stay lever, ratchet dog, and weight, for the purpose of successively turning and griping the log in the following manner: the ratchet dog rotates the log the thickness of a lath as the stay lever passes over the movable cam block; in the instant the stay lever passes the movable cam block the stay lever is reversed by the action of the weight, causing the log to be griped and

held stationary by the point of the lever during the process of sawing. The act of turning and griping the log takes place alternately, as the carriage traverses backward and forward in the direction of the arrows. I claim the adjustable rollers and slides, and the adjusting screws with the slides, as described."

65. For an *Improved Rotary Shingle Machine;* Wm. Stoddard, Lowell, Mass.

"The nature of my invention consists of a wheel in which is placed the riving knives, and also the shaving knives and springs, and other apparatus, as shown in the drawings, for adjusting the same, for splitting or riving and shaving shingles by the rotary motion of the wheel in which the knives are placed.

Claim.—"I claim, 1st, The riving knives, the springs to which they are attached or secured, and the dressing knives, the beveled flanched wheel, when they are arranged and operated as shown and described. 2d, I claim the arm, placed at or near the centre of the wheel, or its mechanical equivalent, when made and used for the purposes of sustaining the shingles while the knives are dressing them, as set forth. 3d, I claim the levers, in combination with the springs, for supporting the four springs near the periphery of the wheel, during the dressing of the shingles, substantially as set forth."

66. For an *Improvement in Self-Heating Smoothing Irons;* Chas. A. Read, Waterloo, New York.

Claim.—"I claim, 1st, Making the holes which supply the air to the lamps above the holes through which the lamp tubes are inserted, so that the air, as it enters to supply the lamps, will deflect the flame down towards or against the bottom, to heat it more rapidly and effectually than it would otherwise do, and heat the top less, substantially as described. 2d, Making the inside of the top descend gradually from rear to front, to aid in deflecting the flame down towards or against the bottom, so as to heat it more effectually."

67. For an *Improvement in Tables for Ships' Cabins;* William L. Bass, Cambridgeport, Massachusetts.

Claim.—"I claim a table for ships' cabins, &c., which is formed in sectional pieces by the backs of two opposite rows of adjacent chairs, the said backs being sustained and operated as described, and also susceptible of being reconverted into the backs of chairs, as set forth."

68. For an *Improvement in Surgical Splints;* Smith A. Skinner, Browington, Vt.

Claim.—"I claim the combination and arrangement of the long bar, made to extend above the hips, and to have a counter extension strap applied to its upper part, the thigh and leg rests, and the extension screw applied to the bar, the whole being substantially as specified. And in combination with the long bar and counter extension strip of the groin, I claim the projecting screw arm and its body rest, the same being for the purpose of obtaining extension in direct line of the leg, as stated. I do not claim the application to a simple foot rest and a bar to extend up the leg, of a device for producing lateral movement of the foot rest; but what I claim is, the combining the connected thigh and leg rests with the bar by means of two slide rods and slides, and their set screws, as specified, whereby the whole, the combined thigh and leg rests, may be readily and properly adjusted to any leg, whatever may be the degree of projection of the hip thereof."

69. For an *Improvement in Knitting Machines;* Israel M. Hopkins, Pascoag, R. I.

Claim.—"I claim, 1st, Attaching the locking bars to the same plate or head with the presser bar, in such a manner as to allow them a limited movement, irrespective of the plate or head, under the influence of springs, applied substantially as described, whereby the said bars are enabled to lock the jaws some time before the termination of the descent of the presser bars to close the barbs, and hence, before the commencement of the retreat of the needles, but the necessary continuation of motion of the plate or head to bring down the presser bar is not prevented. 2d, The combination of the spring and the plate attached to the traverser and the tongues attached to the needle bar, the several parts operating substantially as described, to arrest or retard the thread, or produce a back drag, as may be required to tighten the selvage, at the commencement of each row of loops."

70. For an *Improvement in Moulding Clay Pipe Couplings;* J. Putnam, Salem, Mass.

Claim.—"I claim the manner of making the mould, viz: a combination of the two

conic frusta, and their separation cylinder or cylinders, together and with the concave cylindrical block, and the end boards, as specified, the two parts of the core being supported on a spindle that rests on a concave block, and concentric with its curved surface, as specified. I do not claim the mere use of cloth, or an inelastic fabric, to prevent adhesion of the clay to the moulding surface, but I claim the employment of stocking net, or an equivalent elastic material, for the cover or covers on the two parts or frusta of the core, the elastic properties of such cover or covers enabling them to fit closely to the curved surface of the cone without the formation of injurious seams or indentations on the inside surface of the coupling, and besides this, the elasticity of the cover or covers facilitates the removal of the same from the moulded article. I also claim the wire former, made substantially as specified, viz: of a curved wire or blade, the tension stay, and cutter or wire, and the forked stock or handle, the whole being used as specified."

71. For an *Improvement in Water Indicators for Steam Boilers;* Thomas J. Sloan, City of New York.

Claim.—"I claim connecting the float inside the boiler or other vessel with the indicator or mechanism outside, by means of a flexible sleeve or sleeves, or the equivalent thereof, substantially as and for the purpose specified."

72. For an *Improvement in Machinery for Combing Wool;* Chas. G. Sargent, Lowell, Massachusetts.

Claim.—"I claim, 1st, Giving to the feeding apparatus the lapping motion, substantially as specified, by the crank and rockers, or their equivalents, for lapping the fibres of wool on to the teeth of the main comb. Also, in combination with the feed rollers, operated substantially as specified, the employment of the lifting rod, for lifting the fibres preparatory to lapping them on to the teeth of the main comb, and then separating them. Also, in combination with the continuous chain of main comb teeth on which the fibres of wool are lapped, a working comb, which is operated by a peculiar motion like that given to the lapping rollers, by having the said working comb attached to and carried by a frame, operated at one end by a crank, or the equivalent thereof, and jointed to vibrating rods or workers, substantially as specified. I also claim, in combination with the main comb teeth, and with the lapping feed rollers, and the working comb, the employment of a brush or brushes, substantially as described, for holding the fibres of wool after they have been lapped on to the main comb teeth, to prevent them from being drawn out before they are combed. Also, in combination with the endless chain of comb teeth constituting the main comb, the vibrating finger, operated substantially as described, to direct the fibres of wool after they have been combed to the rollers which draw them off and deliver them to the condensing apparatus. I also claim giving to the feed rollers an intermittent rotary motion, substantially as specified, that the required quantity of wool may be fed forward for each lapping motion, and then stop during the pulling or separating. And, finally, giving to the rollers of the condensing apparatus which strip the fibres of wool from the teeth of the main comb, a slow vibratory motion in the direction of their axes, as specified."

73. For an *Improvement in Baths for Coating Metals with other Metals;* Geo. Rogers, Enfield, England.

Claim.—"I claim constructing the bath in such manner that the upper portion of the molten metal at which the article to be coated enters, is separated by a partition from that portion of the upper part of the molten metal at which the coated article emerges, whereby the flux at the two ends of the bath may be kept separate, and the metal at one end of the bath kept at a much higher heat than at the other, substantially as specified; whereby also, pulverulent matter not being a good conductor of heat, may, with important advantages, be employed to cover a portion of the surface of the molten metal, the remainder being covered by flux."

74. For an *Improvement in Knitting Machines;* Henry Burt, Assignor to the Newark Patent Hosiery Company, Newark, New Jersey.

Claim.—"I claim, 1st, The method of constructing the pattern cylinder; that is to say, by dividing the same into two parts, so as to be capable of sliding to or from each other on the supporting shaft, whereby variations in the width of the web may be effected, but having the same pattern. 2d, Combining the pattern cylinder directly with the shifting bar, carriages, and yarn guide, as described, whereby I am enabled to economize space and produce a better action in the machine. 3d, The improved construction of

the carriage and stop motion, by the addition of a second carriage, on which the stop levers and yarn guide are fixed; and these I claim in combination with the shifting bar, as set forth. 4th, I claim attaching the point of the yarn guide by a hinge, and so shaping it that it may be pressed down between the needles to form the selvage, as described. 5th, I claim the hook bars and its hooks, in combination with the needles and sinkers, substantially as set forth."

75. For an *Improved Water Wheel;* Abel Greenleaf, Kingston, Pennsylvania.

Claim.—"I claim, 1st, The combination of the gate with the scroll, substantially in the manner described. 2d, The recess and the apertures leading thereto, in combination with the leather, or its equivalent, substantially as described. 3d, The spiral or wedge-like form given to the portions of the wheel, as represented, in combination with the buckets thereof, substantially as described. 4th, The tapering form given to the floats, in combination with the double cone-like shape given to the portion of the hub to which they are attached, substantially as described. 5th, The change of curvature in the buckets at or near their ends, as shown, arranged so that these ends shall not be overlapped by the ends of the adjoining buckets, substantially as described."

76. For an *Improvement in Machines for Pegging Boots and Shoes;* Leander Lackey, Sutton, Massachusetts.

Claim.—"I claim, 1st, The hanging jack or last-holder by universal joint, so arranged as to press against points of inclined spur wheel, and held firmly at proper time by clamp or analogous device. 2d, The receiver, when this is so combined with a concave guide in which it revolves as to receive the peg directly as it is cut from the block, and convey it directly to the hole pierced by the awl. 3d, In combination with the revolving receiver, I claim the awl and punch when made to operate alternately through the compartments thereof, for the purpose of piercing the hole and driving the peg; it being understood that I do not claim, in general, the device of making the awl and punch act alternately with each other, as that is not new. 4th, The rolling spur wheels on which the shoe rests, and is carried at certain times the precise distance for the series of pegs, either for single or double rows. 5th, The manner of making the pegs by cutting them on the box or hopper, as set forth, and feeding along the cord by the alternate motion of a catch operating on the points of the card. 6th, The annular guide that supports the toe while the shoe is being pegged round the heel, and also supports the heel while being pegged round the toe. 7th, The waved cam for the purpose of raising and depressing the shoe to place the pegs in alternate rows. I am aware that one or more of the above-mentioned devices may be dispensed with in some kinds of work; I therefore do not claim the whole as a necessary combination; but I use the whole for common large work, reserving the right to use less or more, as required."

77. For an *Improvement in Ox Yokes;* Heman B. Hammon, Bristolville, Ohio.

"The nature of my invention consists in securing over the end of the bow a ferrule, and securing the bow in the yoke beam with the washers."

Claim.—"I do not claim the ferrule and washers, separate, for they are used for different purposes; but what I do claim is, the combination of the ferrule, or its equivalent, and the washers, for fastening of bows, as set forth."

78. For an *Improvement in Shower Bath;* Daniel P. Baldwin, San Francisco, Cal.

Claim.—"I claim the manner of combining the two directors, and providing one of them with large and the other with small discharge holes, and arranging them so as to be capable of being revolved when it is desired to vary the direction and quantity of the water discharged, and thereby increase or lessen its force upon the body of the bather, substantially as described. 2d, The manner of applying the three-way cock to the supply pipes of the directors, so that warm and cold may be supplied at the same time, and mixed and discharged together, through either of the directors, or warm and cold water supplied and discharged separately, as may be desired, substantially as set forth."

79. For an *Improvement in Hay and Cotton Presses;* Levi Dederick, Albany, N. Y.

Claim.—"I claim, 1st, The bar hinged to one of the doors, and capable of being removed therewith from the opening, in combination with the caps, by which it is retained immediately over the ends of the two doors, effectually assisting the pressure from within and keeping them closed during the operation of pressing. 2d, Providing the caps with flanches on the interior sides, by means of which the bar is enabled to aid in sup-

porting and binding together the two sides of the press during the greatest strain upon them."

80. For an *Improved Fastening for Ear Rings;* Geo. E. Higgins, Syracuse, N. York.

Claim.—"I claim the standard attached to the knob, and serving at the same time as a means of connecting the drop, and as a catch to receive and secure the end of the ear wire, substantially as described."

81. For an *Improved Lathe for Irregular Forms;* Frank Baker, Pepperell, Mass.

Claim.—"I am aware that in the turning lathe of Blanchard, a right last has been turned from a left last, or a left last from a right last; I therefore do not claim such as my invention; but what I do claim is, the particular arrangement of the cutting cylinder, the two patterns, the patterns, and work mandrel, and their tracer rollers, whereby they are made to operate together, substantially as described."

82. For an *Improvement in Trip Hammers;* Bernard Hughes, Rochester, New York.

Claim.—"I claim adding to the stem or rod of the trip hammer a piston working in a cylinder, open on the upper end and closed at the bottom, and provided with regulating cock and valve, substantially as described, by which means I am enabled to add the whole or such part of the pressure of the atmosphere as may be desirable to the weight of the hammer in giving the blow."

83. For an *Improved Catch for Holding the Bit in Brace Stocks;* Charles M. Daboll, Assignor to himself and Austin P. Daboll, New London, Connecticut.

Claim.—"I claim the improved manner of securing and detaching the bit in and from the socket of the brace, by means of the eccentric catch, and the inclined side of the notch in the shank of the bit, operating as described, viz: in such a manner that any force exerted to with the bit will bind it tighter in its place without straining said catch, and by which a slight pressure upon the thumb lever, combined with the catch, as specified, will release its hold upon the bit."

84. For an *Improvement in Machines for Cutting Glazier's Points;* Ward Eaton, Carbondale, Pennsylvania.

Claim.—"I claim the combination of a partially serrated or indented and straight cutter, having a reciprocating vertical motion, with a stationary blade, so that the serrated part of the blade shall cut out one-half of the sheet in points, and at the same time form two of the three sides of the remaining points of the sheet, which are cut therefrom by the straight blade, and thus cut up the entire sheet without waste; and this I claim only when said cutting edges are so inclined to each other as that but one point of the series cut from the sheet shall be cut off at a time, which prevents their warping or bending, substantially as described."

85. For an *Improvement in Potato Diggers;* Chas. H. Dana, West Lebanon, N. H.

Claim.—"I claim the revolving separator, constructed and operated substantially as described, for the purpose of breaking up the raised furrow slice, and separating the potato therefrom."

86. For an *Improvement in Gun Locks;* James Hults, Berlin Township, Ohio.

"The nature of my invention consists in such a construction of a single-triggered gun lock, that it can be readily adjusted in such a manner that the cock can be detached from its cocked position by the slightest touch upon the trigger, or in such a manner that a smart pull upon the trigger will be required to detach the cock from its catch, and when adjusted in the former manner the cock will be held securely until the trigger is touched, by which I am enabled to give to my improved lock all the advantages of the double-triggered lock, and with less liability to accidents."

Claim.—"The combination with the tumbler of a lock, of the jointed levers and the spring, substantially in the manner set forth. Also, the set screw, arranged in such a manner in relation to the jointed levers, the sear, and the tumbler, that by its adjustment the cock can be detached from its cocked position by a greater or less exercise of power upon the trigger, substantially as set forth."

87. For an *Improved Method of Hanging Gates, &c.;* N. W. Cilley, Nottingham, N. Y.

Claim.—"I am aware that a system of connecting levers or links have been used, called the 'parallel motion,' for connecting the end of the working beam with the piston

rod in steam engines, and that the same arrangement has also been applied to other machines to impart a rectilinear motion from a vibrating circular motion; therefore I do not claim any such device; but what I claim is, the method of suspending gates or other structures to bracing levers, jointed to each other and to the gate, or other structure, and to the fixed work, substantially as specified."

88. For an *Improvement in Machinery for Composing Type;* William H. Mitchell, Brooklyn, New York.

Claim.—"I claim, 1st, The combination of the lip with the lifting bar, and with the bar, as specified, the said lip acting as a stopper, against which the line of the type lies in the inclined conductor, and over which the bar lifts the bottom type, so that it falls on the bed, as specified, and the said bar being so adjusted as only to admit of one type at a time being lifted. 2d, Constructing the composing wheel of thin circular plates with teeth therein, so as to receive the type from the conductor, in combination with the plates, which pass between the circular plates and receive the type, preventing their further descent and passing them in line into the groove, as specified. 3d, The tongue to prevent the type jumping over the teeth in the composing wheel as they pass down the inclined conductor, as specified."

89. For an *Improvement in Fire Arms;* Jeremiah Peck, New Haven, Connecticut.

Claim.—"I claim the combination of the independent lever with the cylinder, when so arranged that the cylinder may be revolved and locked, without reference to or use of either the hammer or trigger, and the whole is constructed and combined substantially as described. Also, the combination of the spring shield with the cones or nipples, when so arranged as to cover and protect the caps, without any risk of injuring them, or moving them out of place, and also serves to prevent the recoil of the cylinder, when constructed and combined substantially as described."

90. For an *Improved Portable Grinding Mill;* Lyman Scott, St. Louis, Missouri.

Claim.—"I claim the alternate deep and shallow sections of furrows upon the main grinding surface of the burr, for the purpose of distributing the material over said surface, and preventing a surfeit or clogging upon any one point of said grinding surface, substantially as described. I also claim the method of supporting the shell and adjusting the burr therein, by means of the lower bridge-tree, grooved legs, sockets, and adjusting screw rods, when said legs serve the double purpose of supports to the shells, and guides to the bridge-tree, substantially as described."

91. For an *Improved Saw;* Linus Stewart, Washington, D. C.

Claim.—"I claim the construction and arranging of the saw teeth, substantially as described; that is, each tooth shall project beyond the next one below it, a distance equal to the depth it is intended to cut, and each tooth having its forward edge or sole vertical and parallel to the corresponding edges or soles of all the other teeth, for the purposes set forth."

92. For an *Improved Machine for Paging Books;* Horace Taylor, Springfield, Mass.

Claim.—"I claim the type holder, constructed and operating in the manner substantially as set forth. I also claim the peculiar combination and arrangement of the spring catch, the dog, the ratchet wheel and the pawl, whereby the printing cylinder is held firmly clamped during the operation of printing, and is revolved a sufficient distance to bring a new number over the platen, in the manner set forth."

93. For an *Improvement in Guitars;* Wm. H. Towers, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, Passing the strings through openings in the pins extending from end to end and over their flared and rounded heads, and thence to the head of the finger board of the guitar, for the purpose of increasing the volume and richness of its tones, substantially as described. 2d, Extending the two centre pins to the bottom board of the guitar, against which their lower ends are made to press by the pins, so as to cause them to act as sounding posts, in addition to serving as hold-fasts for the strings, as set forth."

94. For an *Improved Mode of Attaching Blankets to Cylinders for Printing Presses;* William H. Street, City of New York.

Claim.—"I claim attaching one end of the blanket to the cylinder by a row of pins arranged within the cylinder on one side of the opening which receives the gripper shaft,

and the other end to a toothed bar, which occupies a position within the cylinder, and has a screw applied in any way substantially as described, to draw it inwards to tighten the blanket."

95. For an *Improved Mitre-Box;* Mattew Spear, Bowdoinham, Maine.

Claim.—"I claim the two supporters or lumber bearers, connected and turning about a common centre, in combination with the saw guide attached to the same pivot, and so connected by mechanism with said supporters as to cause it at all times to bisect the angle at which the supporters may be set. Also, the turning of the saw guide from its vertical position, as set forth, for cutting any desired angle with the plane of the lumber supporters, substantially as specified."

96. For an *Improvement in Ox Yokes;* Isaac Little, Newbury, Massachusetts.

Claim.—"I claim the making of the yoke in two parts, scarfed, bolted, and confined together, as set forth, and combining with them the sustaining chains, the chain holder, and the stirrup screw and nut, all substantially as specified."

97. For an *Improvement in Self-Heating Smoothing Irons;* Peter S. Howes, Boston, Massachusetts.

Claim.—"I do not claim the combination of a rotary box, a supporting bale or handle, and a spirit lamp, the box being provided with two smoothing faces or surfaces of flats, and made to turn around within the handle, so as to bring either of them downwards after it has been heated by the flame of the wick of the spirit lamp; but I do claim the mode by which I prevent the swashing of the alcohol in the lamp, for causing too great or sudden a flowage of the alcohol through the wick, meaning to claim the air vessel, in combination with the tube, its seat, and the capillary covering, the same being applied together, and in the reservoir of the lamp, and to the wick thereof, and made to operate substantially as specified."

98. For an *Improved Lathe Dog;* David M. Smith, Springfield, Vermont.

Claim.—"I am aware that there is nothing new in a screw stirrup, as applied to the mandrel or centre pin of a common turning lathe, and for the purpose of confining the said centre pin to the puppet head of the lathe; I therefore do not claim such; but what I do claim is, combining the stirrup to the eye of the lathe dog, so that the eye part of the dog shall be made to extend through into the stirrup, and the male screw of the dog be made to screw through the stirrup and against the end of the dog, as stated. Also, to combine a cross bar or rod with the tines of the stirrup, so that the said cross bar shall pass through the eye of the stirrup, and serve to keep the parts together, or from entirely separating when not in use, as specified."

99. For an *Improved Method of Nibbing Saw Teeth;* P. B. Tyler, Springfield, Mass.

Claim.—"I do not claim the making a saw with detachable teeth, where the whole of each tooth is constructed in one piece and detachable from the body or plate of the saw; but what I do claim is, the improved mode of making and fitting each tooth, the cutting nib of it being made so as not only to embrace a rib made in the tooth or body of the saw, but to rest in an angular notch, formed as stated, at the front of the nib, the nib being secured in place by rivets, as specified."

100. For an *Improved Case for Holding Railway and other Tickets;* Joseph Edmondson, Salford, and Caleb Haworth, Marsden, Executors of Thomas Edmondson, late of Salford, England.

Claim.—"We do not limit ourselves to the details set forth, as the same may be varied; but what we do claim is, the case shown in figs. 1 and 2, for holding railway or other tickets."

101. For an *Improvement in Hydraulic Heaters;* Lewis W. Leeds and R. Morris Smith, Philadelphia, Pennsylvania.

Claim.—"We claim the arrangement of air tubes, forming a perforated chest containing the water to be heated, in connexion with the fire chamber therein, thus making a compact portable hot water apparatus of short circulation and efficient action, at a greatly reduced cost, in the manner set forth."

102. For an *Improvement in Machines for Making Hinges;* Edward Brown, Assignor to the Scoville Manufacturing Company, Waterbury, Connecticut.

"The nature of my invention consists in providing machinery furnished with feeding

ways, into which the skeleton hinges, previously cut out to the required form, are placed, and then introduced, one by one, by means of a feeding slide before dies, where the knuckles are turned by means of punches, and the finished hinges then ejected from the machine."

Claim.—"I claim, 1st, The slides, regulated by set screws, substantially as described. 2d, The eccentric rods sliding within the hollow rods, and connected with the slides. 3d, The sliding punches with adjusting screws, arranged as set forth. 4th, The sliding gauge with its longitudinal motion and set screws, for the purpose of securing the hinges while turning the knuckle, in the manner substantially as set forth. 5th, The fast gauge with the preventor. 6th, The slide with the catchers and the spring catchers. 7th, The gauge, in combination with the preventor, for the purpose of preventing the hinge from returning with the feeding slide; the whole being arranged and combined substantially in the manner set forth."

103. For an *Improvement in Magazine Guns;* Edmund H. Graham, now or late of Biddeford, Maine, Assignor to himself and Artemus Wheeler, Lowell, Mass.

Claim.—"I do not claim a rotary magazine connected with the barrel of a fire arm, such being in common use in repeating guns; nor to combine a magazine for powder, balls, and priming, with a hollow cylinder or tube made to encompass and revolve on a gun barrel, while the said barrel is provided with holes or passages to receive the load from the magazine, when the latter is turned round on it into a suitable position; nor the combination of a rotary charge receiver, (placed within the barrel or breech of a gun,) and a stationary loading magazine affixed on the said barrel or breech; but what I do claim is, to combine with the gun barrel and the magazine, when the latter is arranged and made to operate on the former as specified, a slide cut-off and a perforated plate, as made, applied, and operated substantially as described, the same enabling me not only to dispense with a rotary charge receiver and its attendant evils, but to retain the advantages of the arrangement of the two series of powder and ball chambers, in concentric circles on the side of the gun and out of the sight range, and to apply to the magazine and gun barrel, a contrivance which, by its peculiar operation, is rendered less or very little liable to be fouled by the smoke or any gases of the explosions of the charges."

MAY 23.

104. For an *Improvement in Constructing Ships for Safety and Escape;* Jos. Burch, Cragg Hall, near Macclesfield, England.

Claim.—"I do not confine myself to any exact form or dimensions for constructing any of the different parts; neither do I confine myself to the details herein described, so long as the peculiar character or principle of my invention be retained; but what I claim are, the several improvements, as follows: I claim the mode of constructing vessels in two distinct parts, as herein called the parent vessel and the escape vessel, on the principle and manner and for such like purposes as are described."

105. For an *Improvement in Lathes for Turning the Interior Surface of Hollow Ware;* Peter Teal and Chas. Tyler, Assignors to W. P. Cresson & Co., Philadelphia, Pa.; patented in England, April 9th, 1854.

Claim.—"We claim, 1st, The rest, with or without a friction roller attached to or combined with a swinging turning tool, so as to move therewith and bear on the surface on which the tool is operating, substantially as described, for the purpose of keeping the tool in a suitable position in relation to the surface that is being turned, and furnishing a proper seat therefor, in all its movements to follow the deviation of the motion of the surface from a true circle. 2d, Hanging the tool in a frame which is left free to vibrate, and keeping it in contact with the work by a spring, or analogous device, while the axis of the work is fixed, or has its motion limited, substantially as described, or what is equivalent, hanging or supporting the axis of the work in such a way as to allow it to vibrate freely, but keeping it in contact with the tool by a spring, or analogous device, while the tool is stationary, for the purpose of keeping the tool and work in proper contact, but allowing them to yield to any want of truth in the surface of the work, and thereby causing the tool to take about the same depth of cut on all parts of the surface."

106. For an *Improved Machine for Printing Railway and other Tickets;* Joseph Edmondson, Salford, and Caleb Haworth, Marsden, Executors of Thos. Edmondson, late of Salford, England.

Claim.—"We claim, 1st, Causing the type box to be raised and lowered to receive

the ink and print the tickets, by placing it in a swing frame, receiving motion by any means. 2d, Operating the inking roller by attaching it to a slide, which receives motion transversely to the movement of the tickets, by means of a lever operated by an eccentric, or other equivalent device, upon the main shaft of the machine. 3d, Giving rotary motion to the distributing roller, by means of a ratchet wheel, click, lever, stud, incline, and spring. 4th, The stamper or impresser bar working through the table for the purpose of pressing the ticket and the inking ribbon up to the numbering wheels. 5th, The sliding block and the machinery by which it is gradually lowered in the tube, for the purpose of keeping the tickets even, and in proper numerical order. And, lastly, the general arrangement and combination of the several parts of the machine, substantially as set forth."

107. For an *Improvement in Piano Forte Action;* Elon A. Lee, Roxbury, Mass.

Claim.—"I claim, 1st, The arrangement of the adjusting screw and button in such a manner that, instead of acting against the fixed arm of the common jack, it is brought to act on a wire or rod, or button placed in the same manner with the wire, with its button, as represented, or in any manner which is equivalent, so that as the under hammer is raised, this wire or rod by itself, or by means of its button moving in connexion with the under hammer, assists, by pressing against the button of the adjusting screw, to throw off the fly or movable arm of the jack to the recess of the under hammer, at the moment the hammer reaches the string, thus giving a free hopping motion to the hammer without diminishing the force of its blow against the string; and as the tendency of the spring is at all times to bring back the button against the wire or button, (whichever is used,) the extremity of the fly and the under hammer are kept in contact, so that the loose and uncertain movement which in trilling is often experienced in common piano fortes, is avoided. 2d, The combination of levers, connectors, and supporters, by means of which the motion is communicated from the under hammer to the hammer, in the manner represented, or in any equivalent manner, by which I am enabled to dispense with the hammer rails and back catches of common piano forte actions. 3d, The use of the movable connector with its flanch joint, in the manner represented, or in any equivalent manner, for connecting the hammer stem with the supporter, which shall allow the hammer stem, as it is moved, to be carried backward and upward, or in equivalent directions, at the same time, so that the whole course of the hammer stroke shall be nearly at right angles to the string instead of forming an arc of a circle, and producing what is called the drawing movement of common piano fortes. 4th, The connexion of the damper through the under hammer and the hammer with the opposite arms of a lever turning on a fixed fulcrum, so as to give an opposite motion to each; that is, to throw up the damper while the hammer falls, and vice versa, thus enabling me, by the forces which act at the different extremities of this lever, to put the hammer and damper in equipoise with each other, or otherwise, at pleasure, without affecting the key, so that the touch of the key may be made as delicate as desired. 5th, The arrangement of the damper and the wire or rod and the lever connecting it with the under hammer, substantially in the manner described, or in any equivalent manner, so as to dispense with all sockets for the damper wires or lifters to pass through, and also with the damper levers, damper covers, and damper buttons of common piano fortes."

108. For an *Improvement in Smut Machines;* G. B. Turner, Cuyahoga Falls, Ohio.

Claim.—"I do not claim the crimped circular scouring plates, nor any other of the described parts, separately, for they have all been previously used separately; but what I do claim is, the stationary and rotating scouring plates, inverted conical screws, and the blast spout, constructed, arranged, and operating in the manner substantially as described."

109. For an *Improved Primer for Fire-Arms;* Abner N. Newton, Richmond, Ind.

Claim.—"I am aware that a capping lever, differently constructed and arranged, but operated by the cock of the gun, has before been used, and that various devices have been employed for removing the exploded cap; such, therefore, merely of themselves, I do not claim; nor yet the rotating cap cylinder, which is an old device; but I do claim the spring forceps or capping lever, arranged and operated by the cock of the gun, in such a manner that the elastic fingers of the said lever picking a cap from the cap cylinder, or its equivalent, during each rise or back movement of the cock, convey it to the gun, or other fire arm nipple and seat, and hold it thereon, and in working back to their original position, relinquish or ease their hold laterally of the cap on the nipple, whereby

any tendency to jerk the cap off the nipple by upward movement of the capping lever is avoided, and greater pliancy and facility of adjustment is afforded in the operation of the said lever to ensure its perfect action, the said capping lever having a universal joint movement at its fulcrum, or being otherwise equivalently hung or constructed, and being operated by fixed or movable studs and springs, or the equivalent of such devices, substantially as specified. And I further claim constructing the capping lever with a crook or arm, arranged so as to gripe the nipple, and by the specified capping action of the said lever to remove the exploded cap from the nipple, preparatory to a new cap being put thereon, and simultaneously with the picking up of a cap from the cap cylinder, or its equivalent, and with the rising of the cock of the gun or fire arm, essentially as set forth."

110. For an *Improved Pump Valve;* Lewis A. Miles, Hopkinsville, Ohio.

Claim.—"I claim the valve, united by a double hinge to the chamber, in combination with the tongue, which, projecting from the pivot, bears against the top of the valve in rising, and ensures its even action upon the seat in falling, as explained, in combination or otherwise with the closing spring, as described."

111. For an *Improved Excavator for Fence Posts;* Ransom P. Adams, Clinton, Ill.

Claim.—"I claim the arrangement of the drill gearing and clutch upon and within a frame pivoted to and adjustable upon the sliding and adjustable platform, in the manner set forth. Also, making said sliding platform adjustable upon and pivoted to a fixed frame upon a traveling carriage, in the manner described."

112. For an *Improved Apparatus for the Manufacture of Daguerreotype Cases, &c.;* Frank Phoebus, City of New York.

Claim.—"We claim the arrangement of the machine for forming cushions and bands for the linings of daguerreotype and similar cases; that is to say, so combining a series of clamps with a movable block or table for holding the materials as to effect the folding of the cloth down upon the glue and the pasteboard, and the holding it there until the same is set or glued, substantially in the manner set forth."

113. For an *Improvement in Hones;* Isaac Babbitt, Roxbury, Massachusetts; patented in England, March 30, 1854.

Claim.—"I do not claim making razor straps curved in one direction, or of portions of the surface of a cylinder, as this has been done before; neither do I claim the use of metal of any description, as a material for making hones; but what I do claim is, making the grinding surface of hones for sharpening razors convex, or of portions of the surface of a sphere, in the manner described."

114. For a *Ratchet Lever;* Hiram Baldwin, Nashua, New Hampshire.

Claim.—"I claim the application of a dog and ratchet to any moving lever or wheel, in such manner that the usual application of the moving power to the lever or wheel, simultaneously lifts the tooth of the dog from the ratchet on the side to which the lever or wheel is to be moved, or the removal of that power allows it to fall back in its place, rendering the lever or wheel immovable, except in the manner described. And I claim the application of this invention not only to the moving levers of machinery generally, but as also applicable to the securing of ships' tillers or rudders, or to any other like purpose."

115. For an *Improvement in Cheese Hoops;* John Beach, De Ruyter, New York.

Claim.—"I claim the method described, of fastening and unfastening the hoop by means of the roller and hinged hasp, constructed, arranged, and operating together and in combination with the hinged halves of the hoop, for the purposes set forth, and whereby great facility and expedition is insured in the operation of the clasp, the tightening action of the clasp made effective and durable, and the hoop retained from springing or flying open when pressure is applied to the interior thereof."

116. For an *Improved Mode of Balancing Window Sashes;* Alfred J. Clarke, Lancaster, Pennsylvania.

Claim.—"I claim gearing the two sashes together in such a manner that while the balance of the sashes, the one by the other, is preserved, a differential movement is obtained for the two sashes by means of the fixed and traveling pulleys, with their cords, chains or ropes, arranged and operating together with the sashes, substantially as specified.

so that on raising the lower or one sash through a given length of space, the other or upper sash is caused to descend through a less length of space, whereby a wider opening or air space may be procured for the window at its bottom than is obtainable by the ordinary arrangement herein referred to and described, in which the sashes balancing each other are made to move with equal velocities, and the top sash thereby caused to contract or partly close the open air space at the bottom, formed by the highly raised lower sash."

117. For an *Improvement in Counterpoise to Cast Locomotive Wheels;* H. A. Chase, Boston, Massachusetts.

Claim.—"I claim the counter-balance upon the inner face of the tread of the wheel, and independent of the two side plates forming the wheel; this method allowing all the parts of the wheel to expand or contract, independent of the counter-balance, and the counter-balance itself to expand without exerting any strain on the wheel during the casting or chilling processes, as described."

118. For an *Improved Wind Mill;* James Curtis, Chicago, Illinois.

Claim.—"I claim, 1st, The so hanging of the pair or sets of sails upon one shaft extending both ways from the counter, as that when one sail of the pair turns to the wind, its fellow shall, by the partial turning of the shaft, turn edgewise to prevent resistance, substantially as described. I also claim the hanging of the said frames on hollow bearings, in combination with the sails and lines, for the purpose of reefing and furling the sails at pleasure, while the wind wheel is in motion, substantially as described."

119. For an *Improved Self-Acting Power Press;* Elias Davis, Montpelier, Vermont.

Claim.—"I claim the peculiar arrangement of the horizontal levers, vertical levers below the screw and bed plate, in combination with the manner described of constructing and operating the press, whereby an accumulative upward pressure in a straight line can be exerted upon the article being pressed, by reason of its gravity and that of the moving portion of the press, substantially as set forth."

120. For an *Improved Machine for Making Book Covers;* L. Danforth, Buffalo, N. Y.

"The nature of my invention consists in combining a pair of folders having two distinct movements, the edge of the one being the centre of motion of the other, so as to produce a perpendicular and parallel motion in quick succession, thus accomplishing at once what otherwise requires much time."

Claim.—"I claim the combination and connexion of the motions of the two folders, in such a manner that their movements may be used upon the edge of any material, such as a piece of junk, board, wood, or other substance, to fold the cloth, leather, or paper, and form a true, angular, and even edge, in the manner described."

121. For *Improvements in Hot Air Furnaces;* John P. Hayes, Philadelphia, Penna.

Claim.—"I do not claim admitting oxygen into the fire chamber for the purpose of igniting the gas or gases therein, for several plans have been devised, although not very successfully, for the same purpose; neither do I claim the rows of vertical hot air tubes, connected at their upper ends by passages or chambers; what I claim is, the general construction of the furnace, as shown and described."

122. For an *Improved Apparatus for Regulating the Supply of Feed Water to Steam Boilers;* Amos Jacobs, Ithaca, New York.

"The nature of my invention consists in regulating and indicating the height of water in steam boilers, to regulate it by means of the reservoir as a motive power, and to indicate it by the ringing or striking of the bell."

Claim.—"I claim the arrangement of the reservoir and weight, in relation to the boiler and the feed pump, substantially as described, whereby the weight of the excess water is used to regulate the supply by the pump, and to provide for its own return to the boiler."

123. For an *Improved Mechanical Means for Preventing Incrustation in Steam Boilers;* John McMullen, Baltimore, Maryland.

Claim.—"I do not claim scouring the bottom of an upright boiler by means of chains attached to arms of an upright shaft; but what I do claim is, agitating the water in steam boilers, and preventing incrustations in the same, by the action of the spirals coiled around the bars attached to the arms radiating from the shaft having an oscillatory rotary motion, and by the spirals coiled around the tubes having a longitudinal action, as described."

124. For an *Improved Machine for Sawing Thin Boards, &c.;* John Myers and Robert G. Eunson, City of New York.

Claim.—"We do not claim the adjustable and elastic roller beds, for they have been previously used; but what we claim is, 1st, The employment or use of the deflecting plates, one or both placed at the sides of the saw, as shown, for the purpose of preventing the sawed stuff from bearing against the sides of the saw, and expanding the saw kerf, and also for the purpose of allowing a thin veneer saw to be stiffened by plates, one or two, as desired. 2d, We claim the employment or use of the clamp, arranged as shown, or in an equivalent way, so as to have a lateral elastic movement, independent of the roller beds to which said clamps are attached, for the purpose of compensating for the varying thickness of different pieces of stuff, and keeping them in a proper relative position to the saw. 3d, We claim the knives or cutters, placed in the roller beds, and arranged substantially as described. 4th, We claim the employment of an adjustable bed with clamps, as described, in combination with the saw, when the saw has a stiffening plate in line with said bed, by which the stiffened or rounded side of the saw is made the 'line side.'"

125. For an *Improvement in Apparatus for Making Palliasses;* Jas. Pigot, Brooklyn, New York.

Claim.—"I claim gauging the size, stuffing, shaping, tufting, and finishing palliasses of different lengths, widths, and thicknesses, in a more perfect manner than heretofore, by the employment of a frame box or former, having one of its sides made adjustable, while its bottom and ends are adjustable and removable for the purpose of accommodating ticks of different lengths, widths, and thicknesses, and giving them the proper shape and finish; the sides of said box being set off with holes for guiding the tufting operation after the straw has been properly inserted into the tick, and the whole being constructed in the manner described."

126. For an *Improvement in Clover Harvesters;* Thomas J. Steadman, Murray, N. Y.

Claim.—"I claim, 1st, The arrangement of the cutters, in combination with the comb, operating in the manner described. 2d, The rake, in combination with the cutters, as described."

127. For an *Improvement in Processes for Treating Hemp;* Lewis C. Suggett, Lexington, Kentucky.

Claim.—"I claim, 1st, The application of common salt, or other saline substance, to the steep water, in order to enable the removal and separation of the gum, at the most advantageous condition of the lint or harl in regard to toughness and pliancy, and before the induration of the gum about the fibres, without endangering the strength of the latter by decay. 2d, The saturation of the fibre and expulsion of its moisture by immersion in boiling tar, pitch, or oil, for the purpose of more thorough and intimate application of the preserving substance to the fibres, preliminary to their immersion into twine or cordage."

128. For an *Improved Hydraulic Ram;* Joseph C. Strode, West Chester, Penna.

Claim.—"I claim, 1st, The arrangement of the tubes, in combination with the upper part of the puppet valve chamber and with the air chamber, in the manner substantially as described. 2d, The arrangement of the tubes in combination with the top of the puppet valve chamber, in the manner substantially as described."

129. For an *Improvement in Tire Bending Machinery;* R. L. Wright, Blue Rock, Pa.

Claim.—"I claim the arrangement of the adjustable spur wheel with the rising and falling roller shaft of the wheel and the concave bed, for the purpose of bending tire of variable sizes in the same machine, as set forth."

130. For an *Improvement in Locomotive Tenders;* Ross Winans and Thomas Winans, Baltimore, Maryland; ante-dated May 9th, 1854.

Claim.—"We claim the tender with an upper and lower platform, in connexion with and for the purpose of feeding with greater convenience, the furnace of a locomotive steam engine, having upper and lower feeding holes, substantially as described."

131. For an *Improvement in Button Hole Cutters;* Thomas W. Brown, Assignor to William M. Mead, Boston, Massachusetts.

Claim.—"I am aware that a button hole cutter has been made with a sliding and ad-

justable cloth rest, and a knife with a straight edge, which, when the knife was closed, was brought down upon so as to rest throughout its length on the top surface of the cloth rest; now, I do not claim such a contrivance, as my button hole cutter is constructed and operates entirely different therefrom; but what I do claim is, the combination and arrangement of the angular knife or knife edge, the cloth rest, and adjusting screw, substantially as described, and so as to operate together. And I also claim the combining a tubular cutter directly with the adjusting screw, and so that it may perform the functions of a cutter and stop."

132. For an *Improved Bracelet Clasp;* John Mansure, Assignor to Farr & Thompson, Philadelphia, Pennsylvania.

"The nature of my invention relates to the method of making and using the clasp or fastening, when applied to bracelets, armlets, or other similar articles of jewelry or toilet, and also to the device for preventing the bracelet or armlet from slipping to one side or the other, or, in other words, for holding it in the proper position."

Claim.—"I claim the forming of a clasp or fastening for bracelets or children's armlets, by means of the hinged spring arms, and the slot and ears. Also, in combination with the clasp or fastening, the strip or bar for holding the ornament in place when said strip is brought into or thrown out of action by the closing and loosening of the clasp, substantially as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Examination of the Gas of the Philadelphia Gas Works. By Chas. M. Wetherill, Ph. D., M. D.

The following examination of the Philadelphia gas was made for the engineer of the Works, Prof. J. C. Cresson, in the beginning of the year 1852, but, unfortunately, was not completed in sufficient time to be inserted in detail in his Report for that year. As the results of the examination of the gas at that time, by different operators, are at total variance, and since particular pains were taken in my examination to check its results, I have thought proper, with the permission of Prof. Cresson, to offer them in full to the criticism of the scientific public. The analysis was performed with the apparatus of Bunsen, which I made and graduated with care; and following Bunsen's process and precautions, as detailed in the *Hand woerter-Book de Chemie*, vol. ii., p. 1050.* The course of analysis and calculation is as follows:

The gas was tested for carbonic acid and sulphuretted hydrogen by passing through lime water and solution of acetate of lead, (in one instance a direct examination for CO_2, by measurement, was made), of which being found absent, it was dried in the small eudiometer by a chloride of calcium ball, and measured.

The olefiant gas and hydro-carbon vapors were absorbed by a coke ball saturated with a mixture of anhydrous and concentrated sulphuric acid, followed by a ball of oxide of manganese and one of caustic potassa.

Oxygen was absorbed by a phosphorous ball by aid of heat followed by a caustic potassa ball.

The residual gases supposed to consist of nitrogen, light carburetted hydrogen, carbonic oxide, and hydrogen, were transferred to the large

* I discovered a typographical error in one of the equations in this article; on page 1066, the equation $\frac{1}{2}x + \frac{1}{2}y + 2z = B$, should be $\frac{1}{2}x + 2y + \frac{1}{2}z = B$.

eudiometer mixed with a known quantity of oxygen, and the absorption noted after explosion. The resulting carbonic acid having been determined by a potassa ball, the unconsumed oxygen was ascertained by exploding with a known quantity of hydrogen, and the nitrogen obtained by subtracting this oxygen from the volume left as above, by the absorption of carbonic acid.

Calling x = hydrogen,
y = light carburetted hydrogen,
z = carbonic oxide,
A = the sum of combustible gases,
B = the oxygen used for their combustion,
C = the carbonic acid formed, we have, according to Bunsen's formulæ,

$$x = A - C,$$
$$y = \frac{2B - A}{3},$$
$$z = C - \frac{(2B - A)}{3}.$$

On measuring the above results, the temperature was ascertained by an accurate Centigrade thermometer by Greiner, which indicated half degrees. The mercury column in the eudiometer was subtracted from the barometric pressure, which was determined by an excellent Gay Lussac barometer, of Lerehours and Secretan, and the hydroscopic state of the gas also noted. The volumes were then reduced to 0° Centigrade, and 1000 millimetres pressure, *dry*, by the formula.

$\log r' = \log. r + \log. (B - b - T) - \log. [1000 + \log. (1 + d t^\circ)]$ in which

r = measured volume,
r' = corrected volume,
B = barometric pressure,
b = mercury column in eudiometer,
T = tension of aqueous vapors at temperature t°, and
d = 0·003665.

The volume per centage was the calculated

EXPERIMENT A.—*Gas collected in a Sealed Tube at my Laboratory, 206 Cherry Street, Jan. 26th, 1852, 11¼ A. M., letting Gas run for a quarter of an hour before Sealing.*

	r	t°	B m. m.	b mer. col. in eudiomer.	r' Vol. at 0°, and 1000° m. m.
1. Original vol. (*moist.*)	119·0	13°	758·8	67	77·32
2. After absorp. by potassa (*dry*).	118·0	15°	759·6	68	77·35
3. Olefiant gas absorbed "	109·2	14°	759·7	76	71·01
4. Oxygen absorbed by phos. "	110·4	19°	762·6	75	70·97

The rest of the analysis lost in the subsequent explosions.

Jan. 27th.—Gas passed through a solution of acetate of lead for 10 minutes; no precipitate; absence of sulphuretted hydrogen.

Passed through lime water for half an hour, keeping a similar test-tube with lime water alongside for comparison; no carbonic acid could be detected.

B.—Gas collected for analysis, Feb. 5th, at 1½ P. M., same locality. Passed, before collecting, through solution of acetate of lead and lime-water for 10 minutes; no precipitate suffered to escape for 10 minutes before sealing its tube.

	r	$t°$	B. m. m.	b	r' corrected volume.
1. Gas dried in eudiometer by Ca. Cl. ball (dry,)	95·4	17°	754·3	91·2	59·556
2. Olefiant gas absorbed (dry,)	87·0	18°	763·0	98·5	54·234
3. Oxygen absorbed (dry,)	86·0	16°	766·6	100·0	54·153
4. Transferred to large eudiometer (moist,) .	130·8	13°	769·2	379·0	47·332
5. After admission of oxygen (moist,) . .	316·9	15°	768·0	189·0	170·110
6. Explosion (moist,)	210·5	16°	767·0	296·0	90·971
7. Carbonic acid absorbed (dry,) . . .	165·5	16°	768·9	342·5	66·661
8. Hydrogen added (dry,)	456·6	16°	766·3	50·5	308·73
9. Explosion (moist,)	238·1	16°	765·8	268·5	108·82

Checks upon calculations.

1st.—n + combustible gases = 47·332.

x = 22·991
y = 21·665
z = 2·645
n = 0·031

47·332 same as above.

2d.—Let v = combustible gases = 47·301 } = 103·449
a = oxygen consumed = 56·148 }
m = the absorption 79·139 } = 103·449
n = the carb. acid found 24·310 }
$v + a = m + n$.

B, *Second Analysis to Check First Analysis.*

	V	$t°$	B	b	r'
1. Dried ore, Ca. Cl. .	101·8	16°	760·9	83·0	65·189
2. Olefiant gas, &c., absorbed,	94·5	16°	756·9	91·0	59·307
3. Oxygen absorbed, .	94·5	16°	754·5	91·0	59·229

The rest of the analysis lost in the explosion. The walls of the eudiometer were taken of thin glass of the size that Bunsen suggests, but being made of flint glass, and having once injured myself by a breakage of similar glass, I made the several explosions with great circumspection, endeavoring to increase the elasticity by not pressing the tube too hard upon the caoutchouc, by which, in the experiments lost, some of the gases were forced out of the eudiometer.

Feb. 11th, 20 minutes before 11. Same locality. Gas reacted alkaline to litmus paper. Passed for 10 minutes through a solution of nitrate of silver, the solution became yellowish, with a slight whitish precipitate, which, on applying heat to the test tube, became reduced to black silver, acquiring metallic lustre under the burnisher.

During the above analysis, the gas-metre at my laboratory was filled with spirits on account of the cold weather; the gas therefore contained a small proportion of alcohol vapors.

The errors of observation and manipulation I believe to be within $\frac{1}{10}$th of one per cent.

The following table shows the per centage volume of gases, according to my analysis:

Per centage by Volume, Gases dry, at 0° Centigrade, and 1000 Millimetres Barometer.

	A	B 1	B 2
Carbonic acid,	00·000		
Olefiant gas and hydro-carbon vapors,	8·157	8·963	9·023
Oxygen,	0·052	0·136	0·120
Hydrogen,		44·168	
Light carburetted hydrogen,		41·620	
Carbonic oxide,		5·081	
Nitrogen,		0·059	
		100·000	

With regard to the small amount of nitrogen, I would call attention to the fact that Bunsen and Playfair have shown the quantity of nitrogen in gas from coal to be exceedingly small in quantity; their results gave a per centage of 0·01 of this gas.

It was intended that I should have instituted comparative analyses of Philadelphia and New York gas, for which purpose there were given me three sealed tubes, one of Philadelphia gas, the other two from N. York. On examining the sealed ends of these tubes with a microscope, very small holes were noticed in two of them, rendering an analysis useless, since diffusion must have taken place; the remaining tube was so thin at its closed end that the warmth of the hand in examining it exploded the tube.

The following are the results obtained by Professors Booth and Faber, Stewart and Alexander, of which the full details are not given. The first two chemists performed their analysis according to Bunsen's process, using an accurate German thermometer, and a French aneroid barometer, indicating, according to a comparison with an ordinary mercurial barometer, 0·01 of an inch; their report is dated Dec. 30th, 1851.

Profs. Alexander and Stewart examined New York gas (from the Manhattan Company,) collected in the New York Hotel, in the forenoon of Jan. 2d, 1852, and Philadelphia gas collected by Prof. Booth from a burner in his laboratory, in the forenoon of Jan. 1st, 1852. The hydro-carbons were absorbed by chlorine water in the dark, and which, the analysts say, appear slightly in excess from the vapor of naphtha accompanying the potassium used as one of the re-agents. The following table of direct measurements, corrected for 30 inches barometer, and 32° Fahr., is given in Profs. Stewart and Alexander's report:

	Manhattan gas.	Philada. gas.
Carbonic Acid,	0·0222	0·0087
Hydro-carbons,	0·0928	0·0996
Olefiant gas,	0·0344	0·0204
Light carburetted hydrogen,	8·7089	0·3227
Hydrogen,		0·4049
Nitrogen,	0·1231	0·1461
	0·9814	1·0024

The gas volumes of these different chemists are reduced to 32° Fahr., and barometric pressure 30 inches, (about 762 millimetres.)

Volume Per centage.

	Profs. Booth and Faber.		Profs. Alexander and Stewart.	
	N. York Gas.	Philada. Gas.	Manhattan Gas.	Philadelphia Gas.
Olefiant gas,	8·32	6·38	3·50 } 12·95	2·04 } 11·17
Hydro-carbon,			9·45 }	9·93 }
Marsh gas,	32·92	54·84	*32·04	32·20
Hydrogen,	24·04	26·27	*40·20	40·39
Carbonic oxide,	11·60	4·42		
Carbonic acid,	2·10	0·97	2·27	0·87
Oxygen,	0·19	0·04		
Nitrogen,	20·83	7·08	12·54	14·57
	100·00	100·00	100·00	100.00

* Not separated experimentally, but their proportions calculated in the same ratio as in the Philadelphia gas.

As will be seen by a comparison of these results with each other, and with my own, there is no agreement at all between them. Perhaps a publication of the details of the above-mentioned analyses would bring order out of apparent confusion. It is always well to publish details, for not only do they afford sometimes the only means of criticism, but are useful in preserving records of analyses from being lost, when from some newly observed fact a recalculation from the original data is necessary.

For the Journal of the Franklin Institute.

Computed Table of Draft of Flues. By Prof. John C. Cresson.

Having occasion, recently, to prepare a tabulated statement of the effective power of vertical flues under the influence of various conditions of temperature, I have thought it might be made useful to others by publication in the *Journal*, and therefore offer it as a small contribution to the much neglected arts of warming and ventilation.

The numbers at the head of each column represent the temperature, in degrees of Fahrenheit, of the air within the flue; and those in the first column on the left, that of the air outside.

The calculations are made according to the following commonly received formulæ for the expansion, equilibrium, and flow of æriform bodies.

1st. Gay Lussac's law showing their increase of volume to be $\frac{375}{1000}$ or $\frac{3}{8}$ in passing from freezing to boiling points of water with equal increments of volume for equal additions of thermometric heat.

2d. Fluid columns are in equilibrium when their heights are inversely as their densities, or, in case of homogeneous gases, directly as their relative expansion by heat; and this difference of height, or, when heights are equal, their reciprocal densities constitute the effective head creating the draft of flues.

3d. By Torricelli's formula, the velocity of flow under the ascertained head is $V = \sqrt{2\,g\,H}$, and the coefficient of actual discharge is assumed

as that for a thin plate, which well represents an ordinary damper or flue register, $Q = 0{\cdot}625\ A\ V$, or $\frac{5}{8}$ths the theoretical discharge.

The numbers in the body of the table show the quantity of air in cubic feet per minute that will be drawn through a register, or other similar opening one foot square, by a vertical flue of 100 feet effective height at the given temperatures.

To adapt these numbers to flues of different heights, multiply them by one-tenth the square root of the effective height in feet.

It is to be understood that the area of cross-section of the flue is not less than that of all the openings for which the flow is computed; otherwise the computations must be based on its area instead of theirs.

Fahr.	60°	80°	100°	120°	150°	200°	250°	300°	450°
0°	1020	1167	1281	1380	1500	1665	1796	1896	2124
10°	940	1092	1215	1320	1450	1622	1760	1866	2100
20°	840	1010	1145	1256	1395	1580	1725	1833	2075
32°	705	904	1046	1181	1342	1530	1675	1795	2045
40°	594	826	995	1125	1285	1490	1645	1765	2027
50°	426	723	904	1054	1225	1441	1606	1758	2002
60°	0	581	810	975	1163	1394	1566	1697	1980
70°	′	415	699	892	1095	1342	1525	1661	1950
80°	′	0	575	798	1025	1291	1480	1625	1925
90°	′	′	415	688	950	1238	1436	1590	1900
100°	′	′	0	562	866	1178	1391	1550	1874

The small table appended below gives the proper factors to be applied as above, for flues less than 100 feet high:

Height of Flue.	Factor.
10 feet.	0·316
20 "	0·447
30 "	0·547
40 "	0·632
50 "	0·7
60 "	0·774
70 "	0·836
80 "	0·894
90 "	0·948

On the Spheroidal State of Bodies. By Arthur H. Church, Esq. *To Dr. Tyndall, F.R.S. &c.**

The successful method by which, in your last lecture, the existence of a space between water in the spheroidal state and the containing vessel was proved by the complete interruption that space offered to the passage of a galvanic current, has induced me to devise a few experiments on the subject.

I have to describe in the present communication, in the first place, some experiments I have just performed for the purpose of obtaining decisive evidence of the isolation of all bodies in the spheroidal state from the surfaces on which they roll; and in the second place, to offer a few suggestions as to the probable causes of the phenomena under consideration.

*From the Lond., Edinb., and Dubl. Philosoph. Magazine, April, 1854.

It was found by Boutigny, that if into a clean, red-hot platinum capsule acids and alkalies be placed, the acid and alkaline liquids will roll about, repelling one another violently. This, though an interesting example of the suspension of chemical affinity, does not prove the existence of a space between the platinum vessel and the spheroids.

The first experiment I have to mention was this:—I took a copper basin, three inches in diameter and rather more than half an inch deep, polished its concave surface, and covered it with a thin film of silver by the galvanic process. The plated basin was now brought to a very high temperature, and while thus heated, a few drops of a slightly alkaline solution of sulphide of sodium were poured into it. These drops instantly assumed the spheroidal form and rolled about, making, however, no mark or track upon the silver. The source of heat was now withdrawn: the temperature was soon so far reduced that the liquid exhibited its normal properties, the space between it and the silver no longer existed, and a black stain of sulphide of silver covered the dish.

Another instance of the assumption of the spheroidal state has been often noticed. It occurs when ether is placed on the surface of boiling water. Now, if a fixed inorganic acid be dissolved in ether, and the water be colored with litmus, no reddening of the latter will take place as long as the ether remains in the spheroidal state. The acidulated ether and the tinted water cannot, therefore, be in communication; they are separated by a film of air or of vapor.

I pass on to notice in as few words as possible the remainder of my experiments. I have remarked that in certain circumstances spheroidal globules form upon the surface of liquids during the processes of filtration and distillation. The phenomenon to which I refer is exhibited by many liquids, more frequently and conspicuously perhaps by those that are the more volatile. I have observed it with alcohol, water, aqueous and alcoholic solutions, syrup, with essential oils and many other organic substances. I have sometimes, however, found considerable difficulty in its reproduction, and will therefore describe in detail a method which is applicable in most cases for obtaining in this manner an example of the spheroidal state. We will employ a particular instance. If we take cymole, a hydrocarbon belonging to the benzole series, and half fill a bottle two or more inches in diameter with it, placing in the neck of the bottle a perforated cork through which passes a funnel-tube filled with cymole, and having a piece of sheet India-rubber stretched over its mouth, we shall find that on adjusting the funnel-tube till its lower extremity is rather less than half an inch from the surface of the liquid in the bottle, and on letting fall a drop of cymole from it, beautiful spheroidal globules will be formed and roll about for some time, scarcely diminishing in size. This experiment may be performed with great advantage if the cymole be warmed first. An ordinary funnel with a filter may be substituted for the funnel-tube, and will answer well if the lower aperture of the funnel has a diameter of about ·13 of an inch. The experiment may be repeated with other materials with similar effects. That the spheroids are not in contact with the surfaces on which they roll, may be proved by saturating the liquid in the tube with something that shall have a visible effect upon a substance dissolved in the liquid

in the bottle. A beautiful illustration of this occurs when, under conditions similar to those before mentioned, we employ in the funnel-tube a solution of sugar containing sulphocyanide of potassium, and in the bottle a solution of sugar containing sesquichloride of iron; no red coloration takes place until the coalescence of the spheroids with the liquid beneath them. Many other chemical reactions may be made use of with similar results. It is very curious to see a solution of ferrocyanide of potassium floating upon a solution of sesquichloride of iron, while not a trace of Prussian blue is formed. These experiments must of course be recommenced whenever any union of the liquids employed has taken place. The cork spoken of above should have two perforations, one to admit the funnel-tube, and the other to allow the escape of air.

Is the employment of a volatile substance essential to the production of these phenomena? I imagined that this question might be answered by the following experiment. A dish of platinum might be heated strongly, and a drop of melted lead then placed upon it; now if the production of vapor from the substances employed were essential to the formation of the spheroidal state, the lead should at once dissolve and perforate the platinum; if, however, the spheroidal state occurs when two non-volatile substances are employed, the platinum vessel should not be perforated until its temperature has been considerably reduced. The experiment was tried with every precaution to prevent the oxidation of the lead and insure an accurate result; a perforation of the platinum ensued the moment of placing the melted lead upon it. This proves that the production of vapor is essential to the occurrence of the spheroidal state; for it cannot be urged that that condition is never manifested when metals only are employed; for a drop of a volatile metal, mercury (melted mercury, we may say, in order to render its relationship to melted lead the more apparent), placed on an intensely heated surface of platinum instantly assumes the spheroidal form, and evaporating slowly, dances about in the vessel with peculiar movements. Upon thin, sonorous vessels of copper, &c., this movement takes place with such rapidity as to produce a musical tone of high pitch. I have sometimes seen globules of mercury and water rise to the height of six inches from the capsules in which they had been formed.

A word or two in conclusion, as an attempt at an explanation of the phenomena observed may not be out of place.

Since a space always exists between the lower body and that in the spheroidal state, and since that state is not manifested by non-volatile substances, it seems reasonable to conclude that the vapor proceeding from those parts of the liquids nearest to the containing vessel or subjacent fluid tends to assist the internal molecular cohesive force of the drops in assuming and maintaining their spheroidal form. Other forces originated by the temperature may also be in operation.

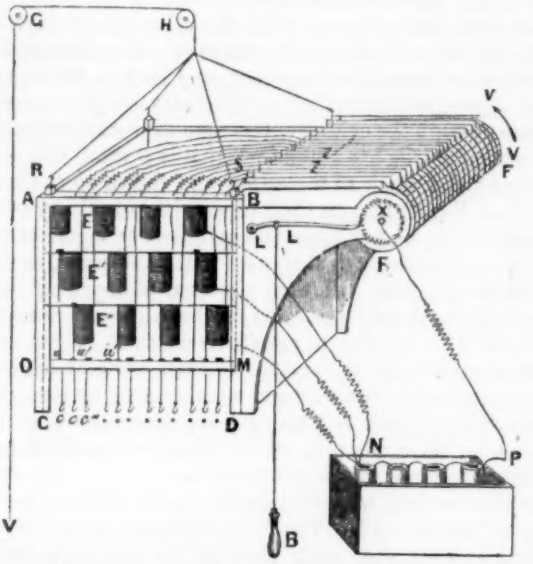
I should premise that the solution of sulphide of sodium employed in my first experiment made a dark stain upon silver even in the cold. This renders the nullity of its action at a high temperature the more remarkable. It will be scarcely necessary to mention, that, for the successful performance of most of these experiments, considerable manipulative care is required.—*Royal College of Chemistry, March* 18, 1854.

For the Journal of the Franklin Institute.

Description of the Electro-Magnetic Loom.

A great deal of attention has been recently paid in France to a proposed modification of the Jacquard loom, in which, by means of the introduction of electro-magnetism, the working of the machine is said to have been rendered much less costly. Considerable acrimony has been shown in a controversy between M. Bonelli, the original inventor, and M. Maumenè and others, who have endeavored to improve upon the original idea, while it was still undergoing improvement at the hands of its deviser. With all this we have nothing to do, but take, for the benefit of our own mechanics, the following description of the apparatus. Nothing doubting that if they find the idea as practically useful as it certainly is ingenious, they will very soon do all that is necessary to replace the old method by the new one.

Fig. 1.



A, B, C, D, the frame containing the electro-magnets E, E′, E″; c, c′, c″, the hooks for raising the threads of the warp, supported by the heads, u, u′, u″, upon the movable platform, O, M. V, the treadle-rod and strap passing over the pulleys, G and H, and holding the platform, O, M, by the cords, R, S. F, F, the cylinder, the axis of which, X, is connected with the pole, P, of the battery. L, L, the ratchet and wheel, by means of which, when worked by the handle, B, the cylinder is allowed to move one tooth in the direction indicated by the arrow, V, V. Z, Z′, the bent wires or teeth, through which the electric current is conducted from the different compartments of the cylinder, to the corresponding electric-magnets.

The idea of M. Bonelli may be explained by the accompanying figure and brief description. The hooks which raise the threads of the warp to allow the shuttle to pass under them, are terminated above by iron heads, and are lifted by bars which rise and fall under a frame which contains

the electro-magnets, of which one corresponds to every hook, and is so placed that when the hook is raised by its bar, its iron head is brought in contact with the face of the magnet. The bar which raises the hooks is itself raised by working the treadle of the loom, by the alternate motion of which it is lifted and lowered, carrying the hooks with it in its upward movement, and suffering them to fall again when it descends, unless they, or some of them, are retained by the attraction of their corresponding magnets. If, then, it is desired that any thread of the warp shall be passed over the filling, the galvanic current from a battery must be passed around the magnet corresponding to that hook of the warp, which will be held until the rest descend, and will keep its thread in the required position to allow the shuttle to pass under it. In order to adjust the contacts so that at each blow of the shuttle, the currents shall pass through the proper magnets, and through them only, a metallic cylinder is prepared, the axis of which is connected with one pole of the battery. Above this cylinder are placed, side by side, a series of metallic wires or strips placed edgewise, bent at one end so as to rest with a slight spring upon the cylinder, while the other end of each strip is connected with the wire of one of the magnets; the other ends of all the magnetic wires are connected together, and lead to the other pole of the battery. It is evident, now, that if the battery be put in action, the current will pass through the cylinder, will then divide, passing through each wire, rendering the iron bar around which it is wound, magnetic, and will then re-unite by the union of the wires, and return to the battery by the opposite pole. But if, now, a drop of varnish, or of any other non-conductor of electricity, be put upon the cylinder, as it passes under one of the wires the current through that wire will be stopped, and its iron core will cease to be magnetic. If then a pattern of any kind be drawn with varnish upon the cylinder, a number of the wires will be thus affected, while others will be left free to pass their currents. Now, whenever the treadle carries up the hooks previous to each blow of the shuttle, those hooks corresponding to the magnets which are in action, (that is, those through which the circuit is passing,) will be retained, and the shuttle must pass under their threads, while those hooks which correspond to magnets not in action, that is, to those whose wires are resting at that moment on the varnish, will drop as the treadle returns, and the shuttle will pass over their thread. The cylinder being, by appropriate mechanism, moved forward after each blow of the shuttle, a new line of the pattern comes under the ends of the wires, and thus other threads are kept up, and the pattern thus worked out upon the stuff.

The principal advantage which is to be gained by this ingenious modification is, in the suppression of the cards, which, in the Jacquard loom, as it now exists, govern the positions of the threads, and are sometimes very costly. (It is said that a set of cards for some of the French shawl patterns cost as much as $5000.)

The objections made to it are, first, its greater expense, the magnets costing perhaps $1·00 apiece, which, in a loom of 500 or 1000 hooks, will add very greatly to the first cost of the machine. It must not be forgotten, however, that this is only a first cost, and that once established the loom is permanent, and when the pattern is done with, it may be

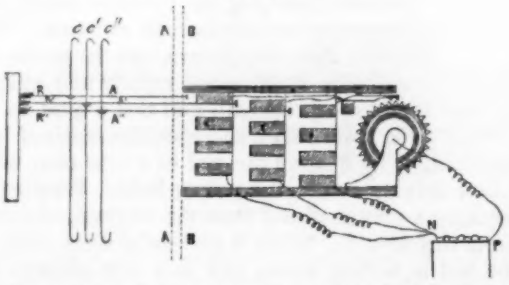
washed off of the cylinder with alcohol or other solvent, and replaced by a new one.

The second objection made to the loom of M. Bonelli is, that it increases the labor of the workman, or if the loom be driven by mechanical power, the force necessary to drive it. For, whereas, in the loom as now constructed, the workman has not, on an average, to raise more than half of the hooks, and the weights necessary to bring them down again; in the new arrangement, the whole of the hooks and weights have to be raised at every blow of the treadle, and at least one-half of them on an average, uselessly, since they return with the sinking of the rod. The battery, too, will require considerable power to hold such a number of weights, and it may be questioned whether the magnetic attraction is sufficient to retain the hooks with certainty against the jars to which all working apparatus is subject; for it must be remembered that the slightest separation of the iron from the polar face of the magnet, weakens the attraction almost indefinitely.

It appears also to be a matter of question among practical weavers, whether a non-conducting varnish can be found sufficiently strong to resist the rubbing of the end of the wires over it, for, should the varnish wear off, the current will pass, and the pattern in the stuff will be defective. Again, although the Jacquard cards are expensive, yet when a pattern is in great demand, and it is desirable to set a number of looms at work upon it at once, the pattern cards are easily and rapidly copied, and the new looms can be set at work without any great additional expense. Can the same be done with the Bonelli loom? M. Maumenè thinks not, and perhaps he is right, although we think that these last two objections will not be found very serious in practice. It appears to us easy to copy the original pattern by transfer, and then the filling up with varnish may be rapidly done, and by a common workman, and upon any number of cylinders, while the original design by the artist is kept.

To remedy these real or supposed objections to M. Bonelli's loom, M. Maumenè, a Professor in the City of Rheims, where the business of weaving employs a large capital and great number of workmen, proposes the following modifications:

Fig. 2.



E, E', E'', the electro-magnets in their frame. A, A, position of the front of the magnet-frame when advanced. B, B, its position when withdrawn. A, A', A'', the needles which are operated on by the magnets. c, c', c'', the hooks which raise the warp. R, R', R'', elastic springs of the needles. P, N, the battery.

The frame of magnets is laid, as it were, upon its side, and is moved

horizontally by a spring to and from the upright beam, through which pass the horizontal needles, corresponding to the hooks of the warp. This motion is controlled by the treadle, and is arranged so that the frame brings the magnets into contact with the needle-heads, and then moves them back again just before the shuttle passes. If the magnets are in action, the needles are retained and drawn aside by them ; if they are not in action, the needles are kept in their places by a spiral spring wound around one end of them. The needles which are drawn aside permit the corresponding hooks to rise; those which remain in place prevent theirs from doing so. By this means the labor is reduced, as in the Jacquard loom, to the lifting of only a certain number of hooks and weights, in place of all of them; the magnets have no longer to exert a powerful attraction to counteract the jar of the loom, but may be made weaker and smaller, and will thus cost less, and occupy less room.

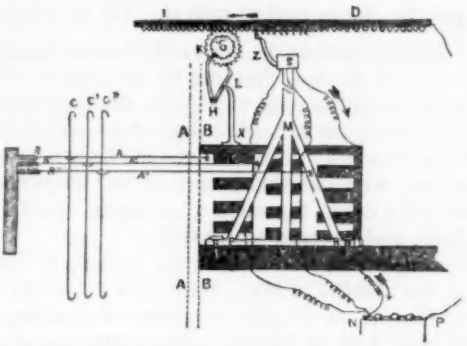
In place of the metallic cylinder of M. Bonelli, with its pattern drawn in varnish, M. Maumenè proposes to substitute one made of sheet brass, perforated with holes punched close to each other, and in straight lines, (a sufficiently stiff wire gauze would probably answer;) over this is stretched a piece of paper thin enough to allow the holes to be seen through it, upon which paper the pattern is drawn. This cylinder is supported around another of a diameter small enough to allow a space of a quarter of an inch between them. The pattern-maker then proceeds to mark out the pattern by driving pins which pass through the holes of the outer cylinder, and rest upon the inner, their length being such that they will project, say, $\frac{6}{10}$th of an inch above the outside cylinder. When the pattern is completed, the pins are secured by pouring fusible metal (which melts in boiling water) between the two cylinders; it will be kept from passing out through the holes in the outer cylinder by the paper which surrounds it, and as it cools, will fix the pins firmly in their places. This cylinder now being substituted for that of M. Bonelli's, under the comb of wires which lead from the magnets, the current will pass whenever a tooth touches one of the pins, while if no pins intervene, the end of the tooth will pass without touching the cylinder itself, and will thus interrupt the appropriate currents. M. Maumenè thinks that the pattern can be worked out on his cylinder much more rapidly and cheaply than on that of M. Bonelli, and that a fault in design may be more easily and speedily repaired by cutting off any superfluous pin, or by heating the end of a new one, when one is to be supplied, and driving it into the proper hole. He proposes to copy patterns by making a plaster mould from the original, and taking fusible metal casts from this mould. When a pattern is done with, the cylinder has only to be laid in boiling water, and in a few minutes the paper is washed away, the fusible alloy melted, and the pins loosened, so that the

Fig. 3.

Enlarged View.

cylinder being washed and dried, is ready for use again for another pattern.

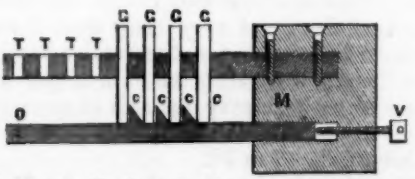
Fig. 4.



A, A, and B, B, are as before the two positions of the magnet frames, E, E'. Z, the teeth or conducting wires, supported on the separate frame, S, M, R. I, D, the plate which takes the place of the cylinder of the first system. K, O, H, L, X, the ratchet system by which each forward and back motion of the magnet frame moves the plate forward one tooth in the direction on the arrow. A, A', A'', the needles. R, R', R'', their springs. C, C', C'', the hooks.

Finally, to gain still further in economy of expense and facility of handling and working the patterns, M. Maumenè proposes to use plane sheets in place of cylinders, which move in horizontal grooves above the loom. They are to be prepared by laying two plates, ¼-inch apart, the upper one of which is pierced with holes, as before, and the under one transversely ribbed or fluted. The pattern is marked, as before, by pins dropped through the upper, and resting on the lower plate, which is at first so placed as to allow the pins to drop into the flutings (between the ribs.) The pins are then secured by giving to the lower plate a small longitudinal motion, so as to press the ribs against the pins. Such an apparatus, M. Maumenè believes, secures the minimum of expense and trouble, and the maximum of rapidity and security for the work.

Fig. 5.



Enlarged view of M. Maumenè's plate, showing its construction.—M, one of the blocks into which are grooved the ends of the upper and lower plates. T, T, the perforations of the upper plates. G, G, the pins, fitting as exactly as possible into the holes. O, the lower plate, with its ribs, c, c, c, and movable for a short distance, longitudinally, by the screw, V.

We do not pretend to express any judgment between the rival claimants, but recommend to our own weavers what appears to us to be an idea full of ingenuity, and of practical availability.

Translated for the Journal of the Franklin Institute.

Note on the difference of Temperature between the Surface of the Earth, and the Air in contact with it. By M. Rozet.

It is known that the surface of the earth is more heated under the influence of the rays of the sun, than the air in contact with it. In 1830 I found that in the neighborhood of Algiers, the temperature of the sand on the sea shore sometimes exceeded that of the air by 30° (Cent.)

In 1850 I began a series of observations at Orange, at 46 metres above the level of the sea, with two thermometers, one suspended in the shade at 1 metre above the earth, the other at a depth of 0·01 m. (0·4 inch,) below the surface, and covered with earth.

In 1851 I continued these observations at Gap, at 750 metres above the sea, during the months of May, June, and July, and I have just renewed them at Tours, at 90 metres above the ocean, during the fine weather of the first half of March. The following are the results obtained: all soils do not heat in the same way, but the law of the variation of the differences of temperature from the air is constant, and the same for all. On a fine day, the sky without clouds, at sunrise, no difference exists; the excess of temperature of the soil over that of the air increases very regularly until about 2 hs. 30 m. of the afternoon; it then gradually diminishes in the same way, until an hour after sunset, when the difference disappears, and thus it remains until sunrise again. Only four times during all the course of my experiments have I found the temperature of the soil at sunrise lower by 1° or 2° than that of the air. At sunset the difference is already only 1·5°, or even 0·5°, so that, generally, the loss of temperature by the surface of the soil to a depth of 0·01 m., does not exceed these quantities. The maximum differences were in March, 9°, in May, 11·5°, in June, 14°, and in July, 14°.

Laying off on a horizontal line from left to right, equal spaces to represent times from sunrise, and raising at every point an ordinate proportioned to the difference of temperature at that time, we get, on clear days, a regular curve, whose horizontal tangent corresponds to 2 hs. 30 m., while the curve bends much more rapidly on the right hand than on the left of that point. After one hour after sunset the curve generally coincides with the axis of abscissas; very rarely does it pass below it; it is true, however, that I have made no observations in winter.

On days when the sky is covered the form of the curve remains the same; but it rises much less above the axis of abscissas. On such days the maximum differences varied in May, from 2° to 4°, in June, from 4° to 6·5°, and in July, from 4° to 7°.

In clear weather, if a cloud covers the sun for 30 minutes only, the difference of the two temperatures evidently decreases, then augments again so soon as the sun re-appears; so that for every such alteration, the curve has a point of contrary flexure.

Several times, when the sun showed himself after a rain, I have found the temperature of the moist ground lower than that of the air, or the difference negative; but if the sun continued to shine, it soon became positive, and the point of flexure was then below the axis of abscissas.

I made some observations during my geodetic stations on the summits of the Alps, and I have ascertained that in the month of June, at 2200 metres of altitude, the difference between the temperature of the soil and that of the air, in fine weather, reached 10°.

My employment not permitting me to follow these observations strictly, I communicate to the Academy the results of those which I have made, to induce meteorologists to resume them, and continue them with more care and regularity than I have done."—*Comptes Rendus de l'Academie des Sciences,* (*Paris,*) 3d April, 1854.

For the Journal of the Franklin Institute.

Application of Branch Currents to the Electrical Telegraph. By M. Petrina, of Prague.

M. Petrina has been employed for eighteen months in constructing break-circuit apparatus for the current, like those which are used in electrical induction-machines. One of these apparatus by its rapid vibrations produced very distinct tones, and gave him the idea of making an electrical harmonica, with a collection of interrupters. He thought at first, that to play on his harmonica he would be obliged to use as many small batteries as he had tones, as he was convinced that otherwise the current by division would become too enfeebled, and that each apparatus would in consequence not give the tone which was expected from it. The experiment, however, showed him that he was mistaken: with a single element for the eight interrupters of his harmonica, he observed neither weakening of the current nor change of tone; and he could, without any difficulty whatever, sound his eight vibrating springs, either together or combined in any way whatever. It could not be otherwise, for the fact demonstrated by the experiment is a necessary consequence of Ohm's theory and of the laws of branch currents. In fact, according to the theory of Ohm, the current of a galvanic apparatus increases in proportion to the diminution of the sum of the resistances to the current; and the law of branch currents requires that each one of the currents shall have the same intensity which it would have if the circuit was closed by that conductor only, admitting, however, that the resistance of the electro-motor is very small or sensibly null, not only in regard to the sum of the resistances of all the circuits, but also in regard to the resistance of each closed conducting circuit.

M. Petrina is astonished that the important theory of branch currents has been, at least to his knowledge, no where applied to the electric telegraph. In the central office at Vienna, there are as many principal batteries as there are telegraphic lines leaving that office, and as many local batteries as there are Morse's recording apparatus. Whilst according to what we have said, a single principal, and a single local battery would suffice, even while messages were being sent along all the lines at once. The only condition to be complied with would be, that the single battery should be strong enough to transmit the signals to the most distant stations; one of its poles would be united with the wires of all the lines, the other pole would, as usual, go to the ground.

Let us designate, by F, the electro-motive force of the pile; by R_1 R_2 R_3, the respective resistances of the different lines; by I_1 I_2 I_3, the intensities of the currents for each closed circuit; we will have, according to Ohm's law, $I_1 = \frac{F}{R_1}$. $I_2 = \frac{F}{R_2}$. $I_3 = \frac{F}{R_3}$.

Since, by hypothesis, the resistance of the battery is infinitely small, in comparison with the resistance of the circuit, and it may be neglected. If the pile is at work at all the stations at the same time, we shall have (calling R the sum of all the resistances, and I the intensity of the current then generated) $I = \frac{F}{R}$; (supposing always that the resistance of the battery may be neglected,) we have, moreover, as every one knows,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \&c.$$

and, consequently, $R = \frac{R_1 R_2 R_3}{R_2 R_3 + R_1 R_3 + R_1 R_2}$.

$$I = \frac{F(R_2 R_3 + R_1 R_3 + R_1 R_2)}{R_1 R_2 R_3} = \frac{F}{R_1} + \frac{F}{R_2} + \frac{F}{R_3} = I_1 + I_2 + I_3.$$

This last equation shows clearly, that when the pile serves all the lines, its natural intensity is the sum of all the intensities of the different circuits separately closed, and as, besides, each branch-current is as intense as it would be if the battery were closed, by its conductor alone, it follows that the branch currents are independent of each other, and exercise no influence on each other, whether they are exerted simultaneously, or one after the other.

What we have just said, evidently applies to the local batteries, and nothing prevents the same battery from working any number of writing apparatus at once. The only practical objection which can be made against the application of the theory is, that the branch-currents of the nearest stations would be too strong for a regular service. M. Petrina answers, 1st, that every good telegraphic apparatus must be able to work with currents of very different intensities; and, 2d, that means are not wanting, to reduce, at pleasure, a current which is too strong. One very simple and appropriate means of doing this is as follows: If the telegraphic lines from the same office are of very different lengths, the battery of the farthest station only will be kept, and the extremities of the other stations will be fixed according to the order of their lengths and the strength of current necessary, so as to use in the circuits, the currents of 12, 18, 14, 30 elements of the battery of the distant station, we can thus take from the one principal battery the elements necessary to constitute the local batteries.

The above discussion is extracted from the *Comptes Rendus of the Sessions of the Imperial Academy of Sciences of Vienna, for* 1853, tom. x, p. 3 et seg. We find, at the bottom of p. 6, the following note: His Excellency, the President of the Academy, remarked that the experiments made at the central office at Vienna, completely confirmed the theoretic ideas which had led M. Petrina to affirm that the number of batteries might be considerably diminished. In this way the number of elements

has been reduced at Vienna, from 480 to 84; at Verona from 180 to 60; at Trieste from 150 to 84; at Salzburg from 180 to 60; at Oderberg from 96 to 36. In place of 1102 elements formerly employed at all the stations, only 324 are now used. This is, as will be seen, a considerable progress, and the example of Vienna deserves to be followed everywhere. We have heard it vaguely rumored that at the central telegraph office of Paris but one battery was used for the whole of the lines.

In another note inserted in the July number of the *Compt. Rend. of the Imper. Acad. of Vienna*, p. 375, M. Petrina indicates another new mode of simplifying telegraphic correspondence at great distances. Four successive stations, A, B, C, and D, are connected together in the order of the letters, and it is required to correspond with D. In the received arrangement, the current goes from A to B; at B it simply brings into action another battery called the "relay," and goes to the ground. The current coming from A must have a certain intensity which we will designate by I; calling R the sum of the resistances between A and B; F the electro-motive force necessary to generate the current to overcome them, we shall have $I = \frac{F}{R}$. Supposing that the relay at C has the same sensitiveness as that at B, the station B must send to C a current of the same intensity I, and if we designate by R, the total resistance between B and C, and by F′ the corresponding electro-motive force, we must have, again, $I = \frac{F'}{R'}$; and, finally, in the same way for the station C; $I = \frac{F''}{R''}$. Let us now conceive that the relay apparatus at B and C are suppressed, and that the batteries placed at A, B, and C, are united through telegraphic wires by their poles of contrary names, so as to constitute but one pile; then in this pile the electro-motive forces F F′ and F″ will be in action at once, and since the sum of the resistances between A and D is R+R′+R″, (if we subtract the resistance of the relay apparatus which has been removed,) we shall have for the intensity of the current given by this compound pile, $I' = \frac{F+F'+F''}{R+R'+R''}$.

On the other hand, we deduce from the three equations already established, I R=F. I R′=F′. IR″=F″), I $(R \times R' \times R'') = F + F' + F''$: $I = \frac{F \times F' \times F''}{R \times R' + R''}$; consequently, I=I′.

Thus, in the two arrangements adopted, whether each battery works separately, or the three piles are united so as to work as one pile, the effect produced is the same. But as uniting the batteries together, the resistance of the relay apparatus is suppressed, (a resistance which M. Petrina has shown to be equal to from 14 to 18 leagues for each one of them, according to the size of the conducting wire of the line,) it is evident that I′ will always be greater than I, and that by adopting the second arrangement, force will be saved, and more in proportion as the line is longer, to the extent of suppressing one battery in every three.

The experiments of M. Petrina prove, first, that so far as the intensity of the current is contained, it is indifferent whether we accumulate all

the resistances outside of the battery, between the two poles, or distribute them by equal or unequal parts between the elements of the pile, as it were in its interior. Secondly, that telegraphic signals are transmitted perfectly and without any disturbance or irregularity through the circuit of a battery thus divided. Thirdly, that the signals may leave any point in the circuit, and may be received at any other point. Fourth, that with the same current by which a telegraphic signal is sent from A towards D, a signal may be sent from D towards A, there being no necessity for placing in the circuit a battery at D. Fifth, that if we unite into one, several powerful batteries, each one of which, by its total resistance, gives a current of the intensity, *i*, the one compound battery will produce a current of the intensity, *i*, admitting that the sum of the resistances of the partial batteries remains the same.

To avoid the objection which might be made to him that he had not verified the results of his theory on sufficiently long telegraph lines, M. Petrina, by introducing between the batteries with which he was working, voltameters filled with water, more or less conducting, made artificial circuits whose resistance was equal to that of a telegraphic conductor of 200 leagues in length. Sustained by this verification, he thus concludes: "Since the modification which I suggest, gives more surety in the transmission of signals, spares force, and consequently expense, requires no new arrangement nor addition in existing apparatus, I have every reason to hope that it will be adopted, and that the relays, which are not only useless, but hurtful, since they create a resistance without any good effect, and which may, moreover, be utilized by employing them as relays for the printing apparatus to be introduced into the line, may be suppressed."—*Cosmos*, vol. iv., p. 352.

Remarks.—We translate the above extract, because it contains the theory of what has been practised in this country for many years on our telegraph lines, and because it serves to show, how very superior we are here in our practical application of scientific discoveries.

Both the discoveries of M. Petrina, viz: the working of several telegraphic circuits by the same battery, and the union of the batteries of different stations by connecting their opposite poles, have been in use in this country upon the Morse lines, since 1847 and 1848, at least. See "*Vail's Description of the Electro-Magnetic Telegraph*," 1847: pp. 24 & 45. It is evident, however, that Mr. Vail did not know that he got the full effect of the battery over each circuit. The testimony given in the celebrated case, French et al. *vs.* Rogers, in which the whole subject of electric telegraphing was thoroughly discussed, shows that the use of a portion of the main battery to work the registering circuit, as well as the combination of all the batteries at various stations into one, was well known to the practical telegraphic operator here. See *Complainant's Testimony*, p. 104, and "Plate IV, facing p. 68." As to the lines thus worked, it is in daily use from Philadelphia to Pittsburgh, (300 miles,) and it has at times been done from Philadelphia to Cincinnati. One great practical advantage, and perhaps the greatest, has been entirely overlooked by M. Petrina and his commentators. It is the more equal distribution of the electrical intensity throughout the circuit, and the consequent preservation of better insulation along the line. For i

100 cups be required to work the telegraph from Philadelphia to Pittsburgh, and the battery be all at Philadelphia, the intensity of the current near the battery renders it liable to overcome the resistance in a damp part and return to the negative ground-plate by a short circuit. But if the battery be distributed, 25 cups at Philadelphia, 25 at Pittsburgh, and 25 at each of two intermediate stations, then the tendency of escape at any point of the line is reduced to one-fourth, and the same insulation is four times better (roughly speaking) for this current than for the former.

We recommend these facts to Paris and Vienna, and advise them to make themselves familiar with the practical knowledge which the telegraph operators in this country possess.—Ed.

For the Journal of the Franklin Institute.

The Transatlantic Steamship Herman. By B. F. Isherwood, Chief Eng. U. S. Navy.

The *Herman* is one of the line of steamships plying between the cities of New York and Bremen, touching at Cowes and Southampton. Her total cost was $324,000, including machinery. She was constructed at New York by Westervelt and Mackay; launched September, 1847, and completed March, 1848. The machinery was furnished by the Novelty Works, of New York, and cost $152,000. The following are the dimensions of the hull, machinery, &c.:—

Hull.

Length on spar deck,		241 feet.
Length on water line at 19½ feet draft,		235 "
Breadth extreme,		40 "
Depth of hold,		31 "
Depth of keel and false keel below planking,		16 inches.
Deep load draft, leaving port,		21 "
Light " entering "		17 " 9 inches.
Mean draft with half coal out,		19 " 4 "
Displacement at 19½ feet draft,		2645 tons.
Displacement per inch of draft at 19½ feet draft,		17·4 "
Displacement at 19½ feet draft, in proportion to circumscribing parallelopipedon,	0·546	
Displacement at 19½ feet draft, in proportion to cylinder, having for base the area of the greatest immersed transverse section,	0·600	
Area of the water line at 19½ feet draft,		7294 square feet.
Area of the water line at 19½ feet draft, in proportion to circumscribing parallelogram,	0·776	
Greatest immersed transverse section at 19½ feet draft,		655 square feet.
Area of greatest immersed tranverse section at 19½ feet draft, in proportion to circumscribing parallelogram,	0·909	
Angle of entrance of the water line at 20 feet draft,	51°	
" " " " 10 " "	36°	
" clearance " " 20 " "	62°	
" " " " 10 " "	25°	
Angle of dead rise of the greatest immersed transverse section,	8°	
Launching draft of the hull with 53 tons of kentledge on board,		10 feet 8 inches.
Displacement per inch of draft at 15¾ feet draft,		15·833 tons.

Weights Carried.

Machinery, exclusive of water in boilers,	450 tons.
Water in first set of boilers,	120 "
Coal bunkers, iron diagonal braces for hull, fastenings, &c.,	25 "
Joiner work throughout for passenger accommodations, boiler deck, masts and spars, &c.,	50 "
Rigging, chains, anchors, &c.,	30 "
Ballast,	73 "
Coal carried,	867 "
Weight of hull,	1050 "
Weight of freight and passengers, with effects, &c.,	328 "
Corresponding to a draft of water of 21 *feet,*	2993 tons.

ENGINES.—Two side lever, condensing engines; the cylinder valves are of the balance poppet kind, cutting off the steam by Stillman & Allen's adjustable arrangement.

Diameter of cylinders,	72 inches.
Stroke of pistons,	10 feet.
Space displacement of both pistons per stroke,	565·48 cubic feet.
Steam space comprised at *one* end of *both* cylinders, between the pistons and cut-off valves,	22 "

First Paddle Wheels, (used on the 12*th and* 13*th Voyages*).—Of the common radial kind; each paddle was in two pieces of equal width, 18 inches each, one piece on the front and the other on the back of the arm.

Diameter from outside to outside of paddles,	36 feet.
Length of each paddle,	8 "
Width of each paddle,	36 inches.
Area of two paddles,	48 square feet.
Immersion of the lower edge of the paddle at 19½ ft. draft,	7 feet 1 inch.
Number of paddles in one wheel, 28	
Number of paddles in one wheel in the water, at 19½ feet draft, 7	
Total immersed area of paddle surface at 19½ feet draft,	336 square feet.
Distance traversed per revolution of the wheel by the centre of pressure of the paddles,	106·8 feet.
Oblique action of the paddles with an immersion of 7 feet 1 inch, in per centums of the power applied,	20·17

Last Paddle Wheels, (used on the 14*th,* 15*th,* 16*th, and* 17*th Voyages*).—Of the common radial kind; each paddle was in a single piece.

Diameter from outside to outside of paddles,	36 feet.
Length of each paddle,	8 "
Width of each paddle,	26 inches.
Area of two paddles,	34⅔ square feet.
Immersion of the lower edge of the paddles at 19½ ft. draft,	7 feet 1 inch.
Number of paddles in one wheel, 28	
Number of paddles in one wheel in the water at 19½ feet draft, 7	
Total immersed area of paddle surface at 19½ feet draft,	242⅔ square feet.
Distance traversed per revolution of the wheel by the centre of pressure of the paddles,	108·4 feet.
Oblique action of the paddles with an immersion of 7 feet 1 inch, in per centums of the power applied,	20·17

First Boilers, used on the 12*th and* 13*th Voyages.*—Two in number, of iron, placed side by side, with one smoke chimney in common. The heating surface is arranged in single return ascending flues. For each boiler the lower or direct flues are 24 feet 5 inches in length, and con-

sist of fourteen 10 inches diameter, two of 18 inches diameter, and two of 24 inches diameter; the upper or return flues are 28 feet 10 inches in length, and consist of six 18 inches in diameter. That portion of the shell of the boiler containing the flues is circular, 28 feet long, and 12½ feet diameter. The furnaces are, for each boiler, three in number, 7 feet long; the side furnaces are 58 inches broad, and the centre furnace 41 inches broad.

Length of each boiler,	36 feet.
Breadth " " at furnaces,	15 " 1 inch.
Height " " "	13 " 10 "
Area of the total heating surface in the two boilers,	5944 square feet.
" " grate " " "	183 " "
Aggregate cross area of lower or direct flues in the two boilers,	34·91 " "
" " " upper or return " " "	21·21 " "
Cross area of the smoke chimney,	27·27 " "
Height of the smoke chimney above the grates,	75 feet.
Distance traversed by the heated gases from the centre of the furnaces to their delivery into the chimney,	62·33 feet.

Proportions.

Proportion of heating to grate surface,	
" grate surface to cross area of lower or direct flues,	32·48 to 1·00
" " " " upper or return "	5·24 "
" " " " smoke chimney,	8·63 "
Square feet of heating surface per cubic foot of space displacement of pistons per stroke,	10·5114 "
Square feet of grate surface per cubic foot of space displacement of pistons per stroke,	0·3236 "

Last Boilers, (used on the 14th, 15th, 16th, and 17th Voyages.)—Four in number, of iron, placed in pairs back to back, with two smoke chimneys, one to each pair of boilers. The heating surface is arranged in horizontal tubes returned above the furnaces. Each boiler contains 199 tubes of 3¼ inches outside, and 3 inches inside diameter; they are all 9 feet 10 inches long, and contain 1664·94 square feet of surface. The entire shell of the boiler is circular. There are three furnaces in each boiler 6½ feet long; the side furnaces are 3¼ feet broad, and the centre furnace 4¼ feet broad.

Length of each boiler,	14 feet.
Diameter " "	12 " 6 inches.
Area of the total heating surface in the four boilers,	8352 square feet.
" " " grate " " "	279·5 " "
Aggregate cross area of the tubes,	39 " "
" " " " smoke chimneys,	47·5
Height of the smoke chimney above the grates,	75 feet.
Distance traversed by the heated gases from the centre of the furnaces to their delivery into the chimney,	23·58 feet.

Proportions.

Proportion of heating to grate surface,	29·88 to 1·00
" " grate surface to cross area of tubes,	7·17 "
" " " " " smoke chimneys,	5·88 "
Square feet of heating surface per cubic foot of space displacement of pistons per stroke,	14·7698
Square feet of grate surface per cubic foot of space displacement of pistons per stroke,	0·4943

Steam Logs.—I have been kindly furnished by Mr. L. S. Bartholomew, with the steam logs of the *Herman*, for the voyages during which he was

Chief Engineer of her. These logs, which were very carefully kept, I have arranged in order, and compiled from them a summary which presents the general results in connexion. They are particularly valuable as showing the different effects produced with the same vessel and engines, by different boilers, paddle wheels, and fuel, the data being the result of a sufficiently extended course of steaming to entitle the means of so many observations to very great confidence. The indicator diagrams, of course, furnish with great certainty the points of cutting off, the difference between the boiler and initial cylinder pressure, and the mean effective pressure throughout the stroke. The temperature of the hot well was kept very regularly at 120° Fahr., by a thermometer. The throttle throughout was carried wide open. The vacuum in the condenser averaged 25 inches of mercury. With the first boilers, which were used on the 12th and 13th voyages, the fuel was burned with a strong artificial blast, produced by centrifugal fans driven by small steam cylinders. These boilers burned Pennsylvania anthracite on the easterly, and Welsh anthracite on the westerly voyages. The last boilers used the natural draft only, and burned Cumberland bituminous coal on the easterly, and Welsh anthracite on the westerly voyages. By anthracite I mean coal containing 85 per centum, and over, of fixed carbon. The last boilers were used on the 14th, 15th, 16th, and 17th voyages. The length of the geographical mile is taken from Frome at 6115·8 feet on the 45th parallel of latitude. The fuel was accurately measured out in tubs, and the average weight of a tub full was ascertained for each cargo of coal. On the westerly voyages the bunkers were filled full at Bremen, and again at Southampton. The number of revolutions made by the wheels was ascertained by a counter, and the distances run each day were determined by observation. The initial cylinder pressure was very regularly 3 lbs. per square inch less than the boiler pressure.

Weather.—An inspection of the steam logs shows that the best weather was experienced in the month of April, and that it became gradually worse with each succeeding month up to October, which is so far as the logs relate.

Of the six voyages made from New York to Bremen, being passages from west to east, occupying in the aggregate, 2354 hours 27 minutes, 1256 hours 56 minutes, or 53·39 per centum, was performed under steam and sail, leaving 1097 hours 31 minutes, or 46·61 per centum, performed under steam alone.

Of the six voyages made from Bremen to New York, being passages from east to west, occupying in the aggregate, 2544 hours 43 minutes, 689 hours 54 minutes, or 27·11 per centum, was performed under steam and sail, leaving 1855 hours 49 minutes, or 72·89 per centum, performed under steam alone.

From the above it appears that sail was carried for twice the time on the eastward voyages that it was carried on the westward voyages.

Expenditure of Stores.—The principal engineer's stores used in addition to the fuel were, oil, tallow, and wiping stuff. Of these, the average expenditure for 24 hours was as follows, viz: oil, 4 gallons 1 pint; tallow, 3 lbs.; wiping stuff, 5½ lbs.

SUMMARY OF THE STEAM LOGS.

Number of Voyage.	DATE.	TOTALS. Duration of the voyage in hours and minutes.	Number of hours under steam alone.	Number of hours under steam and sail.	Double str'kes of engines' pistons, as ascertained by a counter.	Length of the voyage in geographical miles of 6115·8 feet, by observation.	Consumption of coal in tons of 2240 lbs.	MEANS. Double str'kes of engines' pistons made per min.	Speed of the vessel per hour in geographical miles of 6115·8 feet.	Steam pressure in the boilers in pounds per square inch above atmosphere.	Where the steam is cut off at from commencement of stroke of pistons in feet.	Consumption of coal per hour in pounds.	CALCULATED. Slip of the centre of pressure of the paddles in pr cents. of their speed.	Mean effective pressure throughout stroke in pounds per square inch of pistons.	Horses power developed by the engines.
	From New York to Bremen, with Pennsylvania Anthracite, first Boilers and first Paddle Wheels.														
12th,	June and July, 1850.	392 16	78 23	313 53	234550	3592	659·143	9·966	9·157	11·7	5·00	3764	12·31	15·9	782
13th,	August and September, "	388 34	155 34	233 00	237934	3611	663·428	10·206	9·314	12·2	5·00	3825	12·90	16·3	821
	Means,	390 25	116 59	273 26	236242	3601	661·286	10·086	9·236	11·9	5·00	3794	12·60	16·0	796
	From Bremen to New York, with Welsh Anthracite, first Boilers and first Paddle Wheels.														
*12th.	July and August, 1850.	412 21	336 38	75 43	235800	3442	628·165	9·530	8·347	10·9	5·335	3412	16·41	15·7	738
13th.	September and October, "	492 29	353 57	138 32	264705	3596	775·277	8·958	7·302	11·2	5·333	3626	22·20	16·0	707
	Means,	452 25	345 18	107 7	250253	3519	701·721	9·219	7·778	11·1	5·334	3474	19·48	15·9	723
	From New York to Bremen, with Cumberland Bituminous Coal, last Boilers and last Paddle Wheels.														
14th.	March and April, 1851.	407 9	202 24	204 45	242693	3643	563·535	9·935	8·948	11·8	3·537	3104	15·31	13·1	642
15th.	May and June, "	396 47	250 38	146 9	239725	3648	597·000	10·070	9·194	11·2	3·529	3370	14·15	12·7	631
16th.	July, "	368 35	88 19	280 16	232511	3635	556·578	10·514	9·862	10·9	3·500	3383	11·95	12·3	638
17th.	September, "	401 6	322 13	78 53	252880	3693	654·970	10·508	9·207	12·4	3·500	3658	17·61	13·5	700
	Means,	393 24	215 54	177 31	241952	3655	593·021	10·250	9·290	11·6	3·517	2376	14·78	13·0	658
	From Bremen to New York, with Welsh Anthracite, last Boilers and last Paddle Wheels.														
14th.	April and May, 1851.	395 47	237 24	158 23	251168	3664	591·000	10·577	9·258	13·0	3·775	3345	17·69	14 5	757
15th.	June and July, "	386 23	224 40	162 19	246888	3596	570·690	10·650	9·307	13·5	4·083	3309	17·82	15·5	815
16th.	August, "	434 8	360 18	73 50	261242	3636	704·035	10·029	8·376	13·1	3 671	3633	21·47	14·2	703
17th.	October, "	423 35	342 28	81 7	257292	3600	674·800	10·124	8·499	14·3	4·114	3569	21·60	16·4	819
	Means,	409 58	291 12	118 56	254148	3624	635·131	10·326	8·840	13·5	3·908	3470	19·50	15·3	780

* Exclusive of the performance with one engine only, during July 21 and 22, while the other engine was being repaired.

For the Journal of the Franklin Institute.

Observations on a Telegraph Line between Europe and America.

By L. Turnbull, M. D.

The magnificent idea of connecting Great Britain and the United States by telegraph, which has long been a favorite one with me, has been again revived in this country, and received much strength and encouragement from the investigations of the depths and condition of the bottom of the ocean, along the route of the merchantmen between Europe and the United States. According to a recent letter of Lieut. Maury's to the Secretary of the Navy, dated February 22, 1854, Lieut. Berryman availed himself of this opportunity to carry a line of deep-sea soundings from the shores of Newfoundland to those of the Irish coast.

The result is highly interesting, as it bears directly, in so far as the bottom of the sea is concerned, upon the question of a submarine telegraph across the Atlantic, and I therefore beg leave to make it the subject of a special report.

This line of deep-sea soundings seems to be decisive of the question as to the practicability of a submarine telegraph between the two continents, *in so far as the bottom of the sea is concerned.*

From Newfoundland to Ireland, the distance between the nearest point is about 1600 miles;* and the bottom of the sea between the two places is a plateau, which seems to have been placed there especially for the purpose of holding the wires of a submarine telegraph, and of keeping them out of harm's way. It is neither too deep nor too shallow; yet it is so deep that the wires, but once laid, will remain forever beyond the reach of vessels' anchors, icebergs, and drifts of any kind; and so shallow that the wires may by readily lodged upon the bottom.

The depth of this plateau is quite regular, gradually increasing from the shores of Newfoundland to the depth of from 1500 to 2000 fathoms, as you approach the other side.

The distance between Ireland and Cape St Charles, or Cape St. Lewis, in Labrador, is somewhat less than the distance from any point of Ireland to the nearest point of Newfoundland.

But whether it would be better to lead the wires from Newfoundland or Labrador, is not now the question; nor do I pretend to consider the question as to the possibility of finding a time calm enough, the sea smooth enough, a wire long enough, a ship big enough, to lay a coil of wire 1000 miles in length; though I have no fear but that the enterprise and ingenuity of the age, whenever called on with these problems, will be ready with satisfactory and practical solutions of them.

I simply address myself at this time to the question in so far as the *bottom of the sea* is concerned, and as far as that, the greatest practical difficulties will, I apprehend, be found after reaching soundings at either end of the line, and not in the deep-sea.

I submit herewith, a chart showing the depth of the Atlantic according to the deep-sea soundings, made from time to time, on board of vessels of the navy, by authority of the Department, and according to instructions issued by the chief of the Bureau of Ordnance and Hydrography. This chart is plate XIV. of the sixth edition of Maury's Sailing Directions.

By an examination of it, it will be perceived, that we have acquired by these simple means a pretty good idea as to the depression below the sea-level of that portion of the solid crust of our planet which underlies the Atlantic Ocean, and constitutes the basin that holds its waters.

A wire laid across from either of the above named places on this side, will pass to the north of the Grand Banks, and rest on that beautiful plateau to which I have alluded, and where the waters of the sea appear to be as quiet and as completely at rest, as it is at the bottom of a mill-pond.

It is proper that the reasons should be stated for the inference that there are no per-

* From Cape Freels, Newfoundland, to Erris Head, Ireland, the distance is 1611 miles; from Cape Charles, or Cape St. Lewis, Labrador, to ditto, the distance is 1601 miles.

ceptible currents, and no abrading agents at work at the bottom of the sea upon this telegraphic plateau.

I derive this inference from a study of physical fact, which I little deemed, when I sought it, had any such bearings.

It is unnecessary to speak on this occasion of the germs which physical facts, even apparently, the most trifling, are often found to contain.

Lieut. Berryman brought up with Brook's deep-sea sounding apparatus, specimens of the bottom from this plateau.

I sent them to Prof. Baily, of West Point, for examination under his microscope. This he kindly gave, and that eminent microscopist was quite as much surprised to find, as I was to learn, that all these specimens of deep-sea soundings are filled with microscopic shells; to use his own words, "*not a particle of sand or gravel exists in them.*"

These little shells, therefore, suggest the fact that there are no currents at the bottom of the sea whence they came—that Brook's lead found them where they were deposited in their burial place after they had lived and died on the surface, and by gradually sinking were lodged on the bottom.

Had there been currents at the bottom, these would have swept and abraded and mingled with these microscopic remains, the debris of the bottom of the sea, such as oaze, sand, gravel and other matter; but not a particle of sand or gravel was found among them. Hence the inference that these depths of the sea are not disturbed either by waves or currents.

Consequently, a telegraphic wire once laid there, there it would remain, as completely beyond the reach of accident, as it would be if buried in air-tight cases. Therefore, so far as the bottom of the deep-sea between Newfoundland, or the North Cape, at the mouth of the St. Lawrence, and Ireland, is concerned, the practicability of a submarine telegraph across the Atlantic is proved.

The present state of Europe invests the subject of a line of telegraph wires across the Atlantic with a high degree of interest to the government and people of the United States. A general European war seems now almost inevitable; the attitude which this government will assume with regard to all the belligerent powers that may be involved in that war, is that of strict, impartial neutrality.

The better to enable this government to maintain that position, and the people of the United States to avail themselves of all the advantages of such a position, a line of daily telegraph communication with Europe would be of incalculable service.

In this view of the subject, and for the purpose of hastening the completion of such a line, I take the liberty of suggesting for your consideration the propriety of an offer from the proper source, of a prize, to the company through whose telegraphic wire the first message shall be passed across the Atlantic.

From the above interesting and instructive letter, the following points are to be decided by the telegraphic engineer:—

1st. "To find a time calm enough, and a sea smooth enough to lay down a telegraphic cable." In my own mind, this first difficulty can be overcome as easily as the observations of Lieut. Berryman were made, if times of calm are found for such careful observations as he has made, by means of a twine string so as to let down a cannon ball of sixty-four pounds, and then raise a tube filled with the shells and earth of the depths of the ocean, we are almost certain, a time calm enough, and a smooth sea, can be found to stretch a wire cable from land to land.

The second difficulty is, "a wire long enough." On this point we have accurate data to follow. The cable from Calais to Dover, is 24 miles long, and consists of four copper wires, through which the electric currents pass, insulated by coverings of gutta percha. These are formed into a strand, and bound round with spun-yarn, forming a core or centre, around which are laid ten iron galvanized wires of $\frac{5}{16}$ths of an inch in diameter, each welded into one length of 24½ miles and weighing about 15 tons per mile. The rope weighs altogether about 180 tons. It formed a coil of 30 feet diameter outside, 15 feet inside, and five feet high, and was

made in the short space of 20 days, by a machine invented by Mr. George Fenwick, an engineer of the Leaham Harbor Iron Works, in Durham.

The transatlantic cable, if the machinery is multiplied, and sixteen machines are employed, could, we have little doubt, complete the cable in six or seven months.

The third difficulty is, "a ship big enough." This can be no difficulty, for if one would not do, surely twenty would. What is the objection to sending it by trips or in pieces? Could it not be attached, as it was laid down, to a *buoy*. A vessel of 1000 tons could surely carry 400 tons of coil, for our cable would not exceed 12,000 tons.

Another important matter to be determined is, to what extent a galvanic current can be sent on an insulated wire. This has also been determined, for in favorable states of the atmosphere, lines in this country have been so insulated as to work in one circuit from 800 to 1000 miles.

In my work on the Telegraph, p. 152, I there state, that the greatest distance that any of the lines had worked in one circuit, was from Boston to Montreal, via New York, Buffalo, and Toronto; a distance of about 1500 miles. This was done when the earth was frozen and the lines insulated by frost.

The entire length of the telegraph line from New York to New Orleans, via Charleston, Savannah, and Mobile, is 1966 miles, and even this distance has been worked as one circuit by the aid of an instrument termed a connector, the effect of which is to cause one circuit to work the other through the entire series, thus producing a result similar to working through the entire line in one circuit.

As late as December 3, 1853, despatches were written direct through from New Orleans to Philadelphia and New York, on the National Telegraph line, the weather being cold and the earth frozen. In doing so the only connector or repeater used was an insulated screw on the back of the register, invented by a distinguished telegraphic engineer, W. C. McRea, of this city, which is now the simplest mode employed; but this distance would require at least 30 Grove's cups, of a pint each, for every 100 miles, making about 480 cups; or 240 each side. I think this number of the battery of Mr. C. T. Chester,* would be amply sufficient. If a copper and zinc battery were employed, the number would have to be increased to about 30 to 40 cups every hundred miles, but even with this large battery, the expenses would be less than with the Grove's battery. In preparing the batteries, it is even possible to determine mathematically beforehand the amount of resistance and the force necessary to overcome it; and thus to proportion the number and size of the plates to the distance to which the wires extend. Large wires are better conductors than small ones. Copper is a much better conductor than iron; and as a thinner wire answers the purpose of conduction, it may be much more easily insulated.

The several conditions may all be calculated from the beautiful formula of Ohm.

In some recent experiments of Professor Faraday, that distinguished philosopher, by some of the results he obtained, has thrown much light

* For description of this form of Battery, see p. 65.

upon the action of voltaic electricity in the submerged wire of the electric telegraph.

He first determines by actual experiment, that when copper wire is perfectly covered with gutta percha, so high is the insulation that in 100 miles of such wire when fully charged by an intensity battery of 350 pairs of plates and submerged in water, the deflexion of a delicate galvanometer was not more than 5°. The great perfection in the covering of the wire may be judged of by this fact alone. The 100 miles of wire was $\frac{1}{16}$th of an inch in diameter; the covered wire was $\frac{4}{16}$ths; the gutta percha on the metal was considered as 0·1 of an inch in thickness. There could not be any better proof than this, that gutta percha is one of the best insulating agents we have, which fact I have before stated in my work on the Telegraph. He experimented with the subterraneous wires, which exist between London and Manchester, and when they were all connected together so as to make one series, they made almost the distance as determined by Lieutenants Berryman and Maury between the Irish coast and Newfoundland, being 1500 miles, and having introduced galvanometers at intervals of about 400 miles, he found that when the whole 1500 miles were included, it required *two seconds* for the electric stream to reach the last instrument, which was placed at the end. In this instance the insulation was not as perfect, still the result shows that it will require a little over two seconds to cross the Atlantic by telegraph, which is about the rate of 750 miles in a second, which result is far below those obtained by the London and Brussels telegraph, which is stated at only 2700 miles in a second, even with a copper wire, while it will be remembered that Wheatstone, in 1834, with copper wire, made the velocity of the electric current 288,000 miles per second, a considerable difference.

The whole of this difference, according to Professor Faraday, depends upon the lateral induction of the wire carrying the current. "The production of a polarized state of the particles of neighboring matters by an excited body, constitutes *induction*, and this arises from its action upon the particles in immediate contact with it, which again act upon those contiguous to them, and thus the forces are transferred to a distance. If the induction remain undiminished, then perfect insulation is the consequence; and the higher the polarized condition which the particles can acquire or maintain, the higher is the intensity which may be given to the acting forces. In a word, insulators may be said to be bodies whose particles can retain the polarized state; whilst conductors are those whose particles cannot be permanently polarized." And in regard to long circuits, such as those described, their conducting power cannot be understood, whilst no reference is made to their lateral static induction or to the conditions of intensity and quantity which then comes into play.

The conducting power of the air and water wires are alike for a constant current. This, according to Faraday, is in perfect accordance with the principles and with the definite character of the electric force, whether in the static, or current, or transition state. When a voltaic current of a certain intensity is sent into a long water wire, connected at the further extremity with the earth, part of the force is in the first instance

occupied in raising a lateral induction round the wire, ultimately equal in intensity at the near end, to the intensity of the battery stream, and decreasing gradually to the earth end.

In the report of Professor Faraday, which is given in the *Lon. Phil. Mag.* for March, he there in conclusion refers to the terms *intensity* and *quantity*. These terms, he remarks, or equivalents for them, cannot be dispensed with by those who study both the static and dynamic relations of electricity. Every current where there is resistance, has the static element and induction involved in it, whilst every case of insulation has more or less of the dynamic element and conduction; and we have seen that the same voltaic source, the same current in the same length of the same wire, gives a different result, as the intensity is made to vary with variations of the induction around the wire. The idea of intensity, or the power of overcoming resistance, is as necessary to that of electricity, either static or current, as the idea of pressure is to steam in a boiler, or to air passing through apertures or tubes; and we must have language competent to express these conditions and these ideas.

In conclusion, I trust that a cable may be laid across the briny deep, and I am happy to find the matter taken hold of by intelligent and scientific telegraphic engineers, and its completion will be one of the wonders of the age. I have been recently informed that a company has been organized, styled the New York, Newfoundland, and London Telegraph Company, whose object is the establishment of a sub-marine telegraph, to connect Newfoundland with Ireland. Peter Cooper, Esq. a telegraph-wire merchant of New York, is the President, and Prof. S. F. B. Morse, is the Vice President, with a number of Directors. One of the most active is Tal. P. Shaffner, Esq., a gentleman who has had considerable experience in submarine telegraph lines during the past five years, and who employed the following language in regard to the enterprise in the first number of a Journal of which he is editor. "Tides may ebb and flow; the billows may surge with mighty power; the icebergs may tower their white mantled forms high in the skies, and sink deep in the briny sea; the heavens may let loose the loud rolling thunder, and the earth heave up its fiery lava; but just as sure as these elements of nature exist, and worlds revolve, America and Europe will be connected by an electric cord."

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 15, 1854.

Owen Evans, Esq., President, pro tem., in the chair.

John P. Parke, Esq., Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

A letter was read from Edward Cheshire, Esq., Assistant Secretary of the Institute of Actuaries, London.

Donations to the Library were received from The Royal Geographical Society; The Royal Institute of British Architects; The Institute of

Actuaries, and Edward Cheshire, Esq., of London; The National Observatory, Washington, D. C.; W. Milnor Roberts, Esq., Marion, Ohio; East Tennessee and Georgia Railroad Co., Athens, Tenn.; J. Smith Homans, Esq., City of New York; Major Hartman Bache, U. S. Top. Engineers; The Councils of the City of Philadelphia; The Academy of Natural Sciences; Edward Miller, Esq.; Professor John F. Frazer; and John W. Nystrom, Esq., of Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for May was read.

The Board of Managers and Standing Committees reported their minutes.

New candidate for membership in the Institute (1) was proposed, and the candidates (3) proposed at the last meeting were duly elected.

Dr. Rand, Chairman Com. Meet., exhibited several forms of apparatus for cooking and heating by gas. Among them was the *Atmopyre*, a gas stove, in which the gas is mixed with air in a cylinder or frustrum of a cone made of baked clay; the mixture is passed through numerous small perforations and burned. The clay becomes intensely heated, is surrounded by a cylinder of sheet iron with a tube to carry off the products of combustion, and gradually warms the air of the room.

Also, an apparatus for broiling, in which the gas is admitted into a hollow disk and burned in numerous small jets on its under surface, the meat being placed on a gridiron beneath. The whole is surrounded by a short sheet iron cylinder. There is a circular opening in the centre of the disk, so that air is drawn in beneath and around the meat, and carried off above, along with the products of combustion. The meat is thus cooked by radiant heat alone, not being exposed to the gases arising from combustion, or to any free gas which may accidentally escape being burned.

Dr. Rand also exhibited Mr. Andrew Mayer's self-regulating gas nipple. This is a small cylinder, screwed on the branch and to which the burner is attached. It contains metallic valves or washers, so arranged that only a certain quantity of gas can pass. It is varied in size according to the capacity of the burner, so as to allow the maximum quantity to pass to attain an economical effect, after which no increase of pressure causes any additional flow of gas. Mr. Mayer claims as new, the peculiar mode of packing these valves in the cylinder, and his invention is at present under consideration by the Committee on Science and the Arts. Dr. Rand had used one of these on a patent Argand burner, which was very troublesome from its constant fluctuations with those of pressure, due to the proximity of large public buildings. He had found it entirely effectual, but had not had it in use long enough to be satisfied as to its results during a long trial. He had noticed one remarkable effect from its use. Owing, he presumed, to the retardation of the flow of the gas, the flame of the burner took a different form after its application. Instead of presenting the appearance of an inverted cone with a flaring base and somewhat unsteady character, the flame became elongated and entirely steady, resembling that of a Carcel lamp, or of an ordinary Argand.

Dr. Rand called the attention of the members to a dissected leg, preserved by the process of his friend, Dr. John H. Brinton, of this City. After alluding to the disadvantages of the ordinary methods of preserving anatomical specimens by immersion in alcohol, or dessication after injection, Dr. Rand remarked, that Dr. Brinton had, after a series of well-directed experiments, succeeded perfectly in retaining the natural size, form, and appearance of the specimen, by coating it with gutta percha from a solution. The specimen has the appearance of the purest papier maché preparations, and possesses the advantage of presenting not only the natural color of the tissues, but also the relations of the muscles, vessels, nerves, &c. A full account of the process will appear in the forthcoming number of the *Proceedings of the Academy of Natural Sciences of Philadelphia.*

Dr. C. M. Wetherill exhibited an improved modification of Hess' apparatus for organic analysis, in which he makes use of a peculiar form of gas jet for heating the combustion tubes.

(A detailed description of this apparatus will be published in a future number of this Journal.)

Mr. B. F. Day presented a model of an engine for using steam expansively in a second cylinder, and made the following remarks:

The first difference between this engine and others operating on the same principle that have preceded it, is in contradistinction from allowing the steam to pass directly from one cylinder to the other; the taking of the steam from the receiving cylinder to steam chests provided with valves and ports, by and through which the steam is admitted to, and exhausted from, the second cylinder, by which means I retain a longer expansive action of the steam.

The second difference consists in surrounding the second cylinder when used in connexion with a receiving cylinder, with a flue, through which the unconsumed combustible gases are passed after leaving the furnace, by which any loss from radiation will be avoided, and the steam in the cylinders will, to some extent, be reached with caloric.

(This invention is under consideration by the Committee on Science and the Arts.)

Mr. William Reed exhibited a model of his improved form of suspension bridge. He forms a hollow truss-beam of plate iron with cast iron ends the whole length of the span. In this the wire is suspended from the upper end of each extremity and passing towards the lower margin near the centre, the cable and tube being well supported by truss braces, which effect the double purpose of bringing the weight of the truss and all the superstructure of the span on to the cables, and holding the truss-beam in proper shape, acting as the ribs to a vessel.

The height of the truss-beam and the thickness of the iron of which it is made, are to be governed by the length of the span. The upper part of the truss-beam must contain sufficient material to resist the compression of the superstructure and load, and the two feet of the lower edge of the truss-beams with the cables, are to support the whole tension. Where the span is long and breadth of beam is required, in order to save material, the top and two feet of the lower edge of the beam may be made of plate iron, and the intermediate space filled in with wrought iron

bars, riveted from the top to the bottom, crossing each other, forming a lattice so as to preserve the stiffness of the tube or beam. Where footways are wanted, the floor-beams can be extended out for that purpose. By this arrangement the whole amount of the tension of the wire can be obtained, while the peculiar form of the truss-beam will cause any weight that may be brought on any part of the bridge to communicate to all parts of the span.

Mr. William C. M'Rea exhibited a new application of iridium, for which he has applied for a patent. It consists in the construction of "Electro-Receiving Magnets," with their contact-surfaces of iridium. The metal heretofore used for that purpose is platinum, which, although competent to resist the action of the atmosphere, fuses quickly when exposed to the action of the electric spark from a powerful battery in a short-circuit. As soon as the platinum surfaces become in a slight degree oxydized, the points adhere to each other, even when the main circuit is broken. This we may set down as one of the causes for mistakes, which sometimes occur in the transmission of a message by the Morse telegraph, the alphabet of which consists of dots, spaces and lines. It is evident, therefore, that if the points of contact of the receiving magnet adhere to each other when the main circuit of the line is broken by the transmitting operator for the purpose of making a space, that a dot and line, or dots alone, may run together, thereby forming upon the paper a letter or character quite different from the one intended by the transmitting operator.

Iridium being the most indestructible of metals, the advantages of its application, in this instance, are, that the surfaces of contact will last for a much longer time without requiring any change, and will secure a more perfect and unvarying surface of contact for the passage of the current, and prevent the adhesion of the points of contact together.

Dr. Turnbull made some remarks upon the indestructibility of iridium, and said that this new application of it by Mr. M'Rea, would doubtless be found of great importance in the art of telegraphing.

Dr. Turnbull brought before the meeting "a model of a new form of telegraph battery, for which a patent was applied for by C. T. Chester, Esq., of N. Y., Feb. 10, 1854. Dr. Turnbull remarked that this battery, while it does away entirely with local action, employs the cheapest materials and the most convenient arrangement of parts. Its cells are large, of strong glass, and they are insulated from the shelves by a partial coating with electrophorus. Its metals are amalgamated zinc and a peculiar platinized and peculiarly insulated plate, the result of much study and experiment. The plates are supported by metal clamps and thoroughly insulated wood. The construction is such as to secure perfectly against any cross-fire. The plates can be removed and cleaned separately, without stopping the working of the battery. The solution used to excite it is a dilute sulphuric acid. How free it is from local action may be inferred from the fact, that it has been in constant use for five months without being taken down, and that the zincs last such an unprecedented time. The relative cost of working these three batteries, without taking local action into consideration, supposing each equally free from local waste, is as follows; and the estimate is made up from actual experiment, by comput-

ing the destruction of battery material in each, necessary to accomplish a given equal amount of work—say the deposition of a pound of silver in the decomposition trough. To accomplish this,

Grove's consumes—

1½ pounds nitric acid, at 12c.	18 cents.
1¼ pounds zinc, at 10c.,	12½ "
1 pound sulphuric acid,	2 "
	32½

Daniell's consumes—

4 pounds sulphate copper, at 11c.,	44 cents.
1½ pounds zinc,	15 "
1 pound sulphuric acid,	2 "
	61 cents.

The new battery—

1½ pounds zinc,	15 cents.
3 pounds sulphuric acid,	6 "
	21 cents."

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. Charles D. Thum's Varnish Brushes.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, an "Improvement in Varnish Brushes," invented by Mr. Charles D. Thum, of Philadelphia, Pennsylvania—REPORT:

That the improvements claimed by Mr. Thum, consist:

1. In the form of the handle. This is extended below the ferrule, where it is expanded and beveled into a wedge. This gives a greater elasticity to the brush, and renders it superior, in this respect, to any before known to the Committee.

2. In the oval form of the brush. It has been customary to give a beveled form to the varnish brush, by grinding it upon a stone, or by long use upon coarse work, as house-painting. This, however, destroys, in a great measure, the *flag*, and thus impairs the smoothness and evenness of the edge. Mr. Thum gives the beveled form by the arrangement of the hair, the flag being unimpaired. This gives a clean edge, and brushes thus made are found very convenient for working in corners and along edges.

3. In the use of *elastic hair*. The mode of selecting and preparing this hair is not disclosed by Mr. Thum. It appears on examination to be finer, darker, more glossy and elastic than the ordinary hair, and is

flat or oval rather than cylindrical. While a brush composed of this material is more elastic than one of ordinary hair, keeping in better form, the hairs have never, in the experience of the Committee, been known to break or split.

The Committee believe these improvements to be original with Mr. Thum.

On the whole, his brushes are regarded by the Committee as superior to any, whether of foreign or domestic manufacture, which have come under its notice. This opinion is founded not upon mere examination, but embodies the result of actual trial during many months by members of the Committee.

In view of these facts, the Committee fully endorse the opinion of the Committee of Exhibitions, by which a first premium was awarded for the specimens of these brushes deposited in the last Annual Exhibition, and further recommend the award of the *Scott Legacy Medal* and *Premium*.

By order of the Committee,

WM. HAMILTON, *Actuary*.

Philadelphia, June 8, 1854.

Report on Dr. Samuel B. Smith's Electro-Magnetic Machine.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, by Mr. Wm. H. Hazzard, an "Electro-Magnetic Machine," invented by Dr. Samuel B. Smith, of the City of New York, REPORT:

That the peculiarity in the machine consists of an arrangement whereby a succession of shocks may be given to the patient, either from the secondary or from the primary currents at pleasure; whereas, in the ordinary machines, the secondary circuit only can be used for this purpose.

To obtain a shock from the battery or primary current, the circuit is divided before it enters the small magnet, which acts as a brake-circuit, the branch passing to the cord and handle, from whence the current passes through the patient and back to the other handle and cord, to reunite with the original circuit after its passage through the brake-circuit. When the connexions are first made, the current passes through the brake-circuit magnet, and by the attraction of the keeper interrupts the circuit; then if the circuit be completed through the branches, the current will pass by that route, returning to the other when the cessation of the magnetic influence allows the keeper to recede, and thus to open the more direct path.

The arrangement is simple and ingenious; and although it has been made before experimentally by a member of this Committee, (Mr. Weygandt,) has not, so far as the Committee know, ever before been published, or applied in practice. Dr. Smith is therefore entitled to the full credit of the invention.

As to its utility in medical practice, or its superiority over the secondary or induction current, the Committee do not feel competent to express any opinion, though it is but fair to mention that they have heard a very favorable opinion expressed of it, by a medical gentleman of this city,

whose scientific knowledge and experience give great weight to his opinion.

The Committee recommend the Committee on Exhibitions to award to Dr. Smith a first premium for the Instruments deposited in the last Exhibition.

By order of the Committee,

WM. HAMILTON, *Actuary.*

Philadelphia, June 8, 1854.

Report on Mr. Gatchell's Model of a Lightning Rod.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination by Mr. A. C. Brown, the "Model of a Lightning Rod," constructed by Mr. J. L. Gatchell, of Elkton, Maryland—REPORT:

That in the proposition presented by Mr. Brown, no claim is made for any "new invention," but for "a new combination and arrangement of what has heretofore been used." In effecting this new combination, which is intended to include in it all that has heretofore been by experience found useful, the requisite attention has been paid in succession to the point, the body of the rod, and its termination in the ground.

In regard to the point, it is constructed by "sharpening the iron-rod so as to receive the usual gilt platina point; sliding down on this point, is a ball or button of zinc, into which are cast six or more pointed copper wires, each diverging from the main point." This arrangement is credited to Dr. Hare, to whom it belongs.

There can be no doubt of the increased efficiency of a rod thus constructed, although we think that the reason given by Mr. Brown for this increase, is not the true one. There is, so far as the Committee know, no experiment to show that a single point, when in good condition and properly connected with the earth, is not quite sufficient to discharge the heaviest thunder cloud quietly and more rapidly than the cloud can approach it. In all cases where a pointed lightning rod has been struck, and where an examination has been made, the connexion with the earth has been found defective.* But if it be remembered, that Professor Henry has shown that a lightning rod is so far under the influence of a thunder cloud, even at a distance of twenty miles, as to indicate a current through the rod sufficient to magnetize needles, whenever a flash takes place from the cloud; and if we farther notice that when the cloud is at a distance

* This opinion applies especially to conductors on land, for Mr. Harris has given cases of ships being struck at sea, where the lower connexion was probably perfect. But, laying aside the question of defective conduction in chains, to which our remarks on the inductive effects of the lightning rod are peculiarly applicable, these instances would seem to strengthen the explanation we have given of the brush; for a ship at sea will be heeled over to leeward, and have the point of the rod directed away from the cloud, thus losing the first effect upon which we have particularly insisted.

from the rod, the upright point is not presented towards it, and is therefore comparatively, if not totally, inefficient, it will be seen that the brush of points diverging from the rod will be useful, because one at least of them will point towards the cloud, while approaching, at such a time before its reaching the striking distance, as to allow the whole of its electricity to be discharged silently and unnoticed. For it must be insisted on, that the true function of the lightning rod is not to receive a spark from the cloud, and to convey it harmlessly to the ground—whenever this happens, there is insufficiency in the system—but it is to begin its influence by induction, upon the cloud when at a distance, and by the continuance of this influence, to discharge the electricity in a silent and unnoticed current, so that when the cloud, pushed before the wind, passes near the protected mansion, its dangerous content has entirely disappeared and it floats harmlessly on its journey. This view follows necessarily from the experiments of Franklin on the influence of the point, and from the beautiful explanation which Faraday has given of this influence. It serves also to explain why the efficiency of the rod depends upon the area of the cross-section, and not upon its surface. The Committee are aware that Mr. Harris has explained this differently in his excellent treatise upon the lightning rod; but we regard his explanation as erroneous, since Henry has clearly shown by experiment that electricity of tension passes entirely by the surface, and not through the mass of the conductor, and that when passing over a plate, its self-repulsion is such as to cause the greater part to pass by the edges, rather than distribute itself uniformly over the area. The inductive effect, however, which is produced in a rod by a cloud at a distance, will be necessarily of such low tension as to resemble the galvanic current, which, as is well known, passes through the body of its conductor, and not over the surface alone. While therefore, we agree as to the practical value to be attributed to the brush termination of the lightning rod, we suggest the necessity of bending the points outwards, so as to make a large angle (say 45°) with the vertical, as has been done in this rod, although it is not noticed in his communication.

The action of the zinc ball, to prevent or retard the oxidation of the copper rods, is unquestionable.

To form the body of the conductor, "iron rods are put together with screw sockets (same as gas pipes)." There can be no doubt of the propriety of this plan, or that of soldering, for too much stress cannot be placed upon the necessity of maintaining a perfect metallic contact between all parts of the conductor. The method so commonly used, of linking the joints of a rod together, is altogether inefficient, and could only have been adopted under the erroneous notion before alluded to, that the rod is to receive a spark from the cloud. Were this the case, no doubt an interval of even a quarter of an inch, of an imperfect conductor, such as iron-rust, would make but little difference, (except under peculiar circumstances, such as the vicinity of large masses of metal, &c.,) for the discharge which has tension enough to pass over a hundred or more feet of air, will not be turned from its course by a half-inch of iron rust. But such is in reality by no means the case, as we have endeavored to show. The effect of the rod begins while the cloud is at a distance,

and if it be in good order, the cloud should be discharged before it comes into its vicinity. The current thus generated is, however, very feeble, and if it be interrupted by the slightest breaks, the good effect of the point ceases, until tension be accumulated sufficient to force the passage—the electric effect shows itself in sparks, the cloud is but slowly discharged, and there may, perhaps, be a danger of the rod receiving an amount of electricity which it cannot instantly and harmlessly convey to the ground. The joints of the rod should be, therefore, screwed or soldered together, or both, and, as an excess of precaution, where the expense is not an objection, we would recommend that the rod should be of copper, which is a much better conductor than iron; though there appears no record of any thunder-bolt so heavy as not to be safely passed by a bar of iron of one square inch or even less of cross-section.

Where, however, the rod is of iron, as it will be in the great majority of cases, we have no hesitation in endorsing the opinion of Mr. Brown, that "the addition of the zinc ball and copper wires to the lower end of the rod will greatly facilitate the discharge of electricity into the earth." In fact, the Committee believe that the greater part of the accidents which have happened to buildings armed with what were supposed to be properly constructed lightning rods, have arisen from the rusting off of the iron, just below the ground. Generally speaking, the accidents alluded to are trifling, and are principally injurious by shaking confidence in the efficacy of the protection offered; but it is believed that the annoyance from them can most frequently be avoided by securing the free metallic communication between the bottom of the rod and the moist earth. In a city, this is best done by connecting with the gas or water pipes; in the country, the rod should be carried down to such a depth as to insure a constant supply of water. Particular attention to this point should be paid in the case of houses standing upon a hill, where during our continuous dry summer weather the earth is apt to become baked to a very great depth. In such cases, the electric discharge has been seen to pass from the foot of a lightning rod, over the surface of the ground, (probably conducted by the moisture of the grass,) to the springs at the foot of the hill.

Both the zinc balls should be soldered to the rod.

The Committee also agree in the opinion expressed by Mr. Brown, who "does not consider the insulation of a rod important, and has adopted insulators only on account of the time-honored custom of using them."

The law of an electrical discharge is, that it will divide itself between the conductors offering themselves, so that each conductor will take a quantity inversely proportioned to its resistance. Now, if the lightning rod be in perfect metallic contact throughout, and well connected with the ground, the resistance which it offers is almost infinitely less than can be found through any materials of which a building is usually constructed. Cavendish found that water, which is the best conductor after the metals, conducted electricity with 200,000 times less facility; and even though we assume that this number is far too large, yet margin enough is left to justify the assertion that, with a well constructed rod, the divergence of the discharge through any except a metallic conductor is practically unimportant. But this conclusion assumes the rod to be perfect in

all its conditions; for if, whether owing to deficiency in its point or in its conducting capacity, it be struck, it is well known, by the experiments of Faraday and others, that portions of the passing discharge may be drawn off as sparks, and that these sparks will sometimes pass through a considerable distance of a non-conductor. (See *Sturgeon's Kite Experiments.*) Such phenomena (known as the lateral discharge) are annoying, and may in some cases become dangerous; but it is doubted whether insulation is the true mode of avoiding them.

Similar phenomena, perhaps, still more frequently occur, from the inductive effect exerted by the discharge during its passage, upon any masses of conducting bodies insulated from the rod. Such bodies become charged during the passage of the current, and upon its ceasing may give off sparks as they themselves return to the neutral state, which sparks may be a source of annoyance or even danger. The true method of avoiding these effects is to connect every mass of conducting matter at both ends with the rod itself, when every indication of the kind, whether it be due to the branch discharge or to the inductive effect of the primary current, will cease.

Where two rods are erected, they should be connected together along the ridge-pole of the roof.

The Committee, therefore, in conclusion express their opinion, that in the lightning rod submitted by Mr. A. C. Brown, proper attention has been paid to securing the best conditions which a lightning rod should possess; and they believe that the rod, as proposed to be constructed, may and ought to be recommended by the Franklin Institute, as being in a very high degree cheap, durable, and efficient.

By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

Philadelphia, June 8, 1854.

BIBLIOGRAPHICAL NOTICE.

Pocket-Book of Mechanics and Engineering, containing a Memorandum of Facts and Connexion of Practice and Theory. By JOHN W. NYSTROM, Civil Engineer. Philadelphia: Lippincott, Grambo & Co. 1854.

This valuable little Pocket Book is intended, as its title imports, to serve as a memorandum book for all facts and formulæ, which are likely to be frequently wanted by a practical man in any branch of the mechanic arts. A work of this kind, although making no claims to high scientific character, yet requires some of the highest and, in this country at least, most unusual scientific attributes for its proper compilation; accuracy in facts, method in their arrangements, fullness in details, clearness in statement, and with all brevity, are essentially requisite for a guide-book for the practical mechanic, and they are the same qualities, which, with the addition of original conception, form the perfect scientific character.